THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JUNE 15, 1899. CHICAGO, ILL. NUMBER 24

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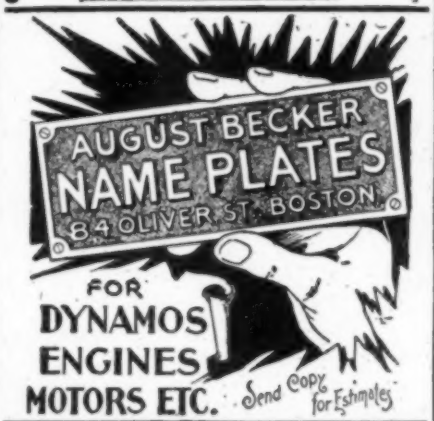

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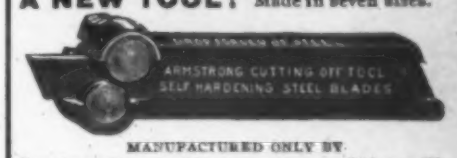

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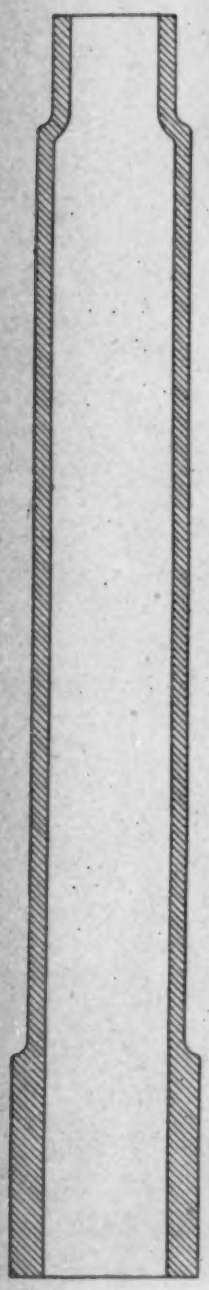

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JUNE 15, 1899. CHICAGO, ILL. NUMBER 24

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Prices of iron and steel continue to advance by the sheer force of a demand that appears to grow even faster than the arguments designed to show that it should begin to curtail. There is no definite indication yet of even the beginning of the end. Structural material has been watched by many as likely to give first and surest signs of contracting demand, but while they have watched, it has been filling up the mills until they are four weeks farther behind than was the case about as many weeks ago. Prices advance steadily in nearly all lines. Producers of various finished products point out one week that they are out of step with the advance in raw materials and straightway decree an advance. The next, producers of pig iron and steel find reasons for thinking that their advances are very moderate compared with what is going on in the other end of the trade. And both together put the responsibility upon insatiate buyers who have pushed up prices by insisting on getting the material required for orders closed and in sight. Prices quoted to-day have not made themselves felt distinctly in lines of ultimate consumption. But with each week the average price of the tonnage on order books creeps up, and the question every member of the trade would be glad to have answered is how near the average order-book price will approach to-day's level. For the two to approximate even measurably would require large buying at the present market and beyond. It is evident that more light on crop developments will be awaited before there is any serious committal of the trade to contracts for 1900. Some sales of foundry iron have been made reaching well into the new year; but in the steel trade, with so high a basis established for the relatively small amount of current buying, there will doubtless be a considerable interval before large contracts for the coming year will be even discussed. Steel for the second half of this year was bought by the large consumers, represented by tin plate, sheet and wire interests, at about $10 below to-day's figures for billets and sheet bars. Comparisons of prices of finished material with billets at $32 are therefore not apropos. A new factor in the advance developed in the past week is railroad freights. Southern roads have given notice of a 50-cent advance on pig iron tariffs, effective June 21, making $1 advance since the present movement began. To Chicago 15 cents additional will be in force June 30, making the Birmingham rate to that district $4.15. The Central Traffic Association, now in session at Chicago, is considerting a general upward movement in iron and steel rates, to be effective July 1. Between the labor advances already established and those certain to be, and the toll taken by already prosperous railroads, the iron trade will pay its bills on the basis of the prices secured for a fraction of its product, while making collections at the timid figures of the dead of the winter. There is quietness in Bessemer pig iron, with $18, valley, established by recent sales, and little selling will be recorded in the next three months, for there is practically no iron to sell, though it is known that Central Western steel works will need considerably more iron before the end of the year. Foundry buying keeps up. The advances of the week have been from 50 cents to $1, with prices irregular—often from $1 to $1.50 apart on similar grades of iron. The scarcity of Southern softeners and Northern high silicon irons is already very marked. In finished materials the advances of the week are in rails, which are now $28 to $30 in the Central West for standard sections; in wrought pipe, which is scarcely obtainable from mills, and is 20 to 25 per cent higher; in sheets and merchant steel. The steady decrease in pig iron stocks noted in preceding months is attracting much attention in view of the smallness of the reserve. Those who had counted on relief from the newly started furnaces find their calculations still upset by the number of furnaces that go out for repairs. Basic iron has been made scarcer by unexpected furnace stoppages.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.* 705 PUBLICATION BUILDING, June 14.

It does not seem to be realized generally by the iron trade that the market is closely approaching a condition of very delicate balance. The late advances in crude materials have come because there was greater pressure to buy than there was to sell, but this was because there was no pressure at all to sell, and the light pressure to buy was sufficient to advance prices. It is but a step further to a lack of pressure on both sides, and then prices will be purely a matter of caprice. There is no danger of the appearance of any pressure to sell, for many months yet. The order books of blast furnaces and steel works might be closed tight for a period of several months without its affecting operations to any marked degree. But the condition of balance is so nearly reached at the present time that there will be room for violent fluctuations before the next large selling and buying movement occurs.

A continuance of prosperity for the iron trade throughout the present year is assured, irrespective of market quotations from now on, but in the interests of strength for the market and permanence of prosperity for next year, it is believed by some of the best heads in the trade that there should be decided recession in market quotations during the period in which the tonnage of transactions is so small as to have no noteworthy influence on aggregate profits.

The wage settlements with organized labor in the past few days serve to emphasize further the fact that the rock bottom of prices in the iron trade in the next year or two, at least, will be a very different thing from the bottoms established in the past. Coming upon the general advances to unskilled and unorganized labor, the advances granted to skilled and organized labor already, and other advances which it is presumed will be agreed upon before the end of the month, mark a very decided enhancement in the cost of all raw materials and the cost of conducting all iron and steel operations. Should adverse influences come, and the tendency become strong toward lower prices, after the first good drop the ground will begin to be contested inch by inch long before the bottom is approached.

The Central Traffic Association meeting Wednesday and Thursday of this week in Chicago is with the avowed purpose of making a general advance on tariff rates. The policy of the railroads is generally condemned in iron and steel circles. It is claimed that the conditions in the freight business

and the producing business are wholly different. Prices of iron and steel products have been forced up by a demand at former prices which the mills were physically incapable of supplying, while the railroads are fully able to handle the present tonnage of freight. The roads are now handling a much greater tonnage of iron and steel than formerly, which in itself will increase earnings through reduction in the charge to each ton for fixed expenses; and besides this they are generally getting their tariff rates, as against the heavy reductions which were common less than a year ago. It is pointed out, too, that an advance in tariff rates (becoming effective July 1 as is intended), after practically all the iron business for the year has been booked and figured upon, will seriously unsettle matters. It is urged that the advance should not become operative until January 1, but it should be noted in this connection that there is simply a conflict here with the general practice of the iron trade in closing business for from six to nine months ahead, and this practice is not necessarily one that is to be commended.

Among the changes in prices to be noted during the week under review are the establishment of a new basis on rails at $28 to $30; a further advance in cold rolled shafting of a quarter of a cent a pound, the new discount being 30 per cent; higher prices on foundry and gray forge pig in the face of a very light demand; an advance of exactly 25 per cent in net prices of merchant pipe, and a further advance in plates.

PIG IRON.—The price of Bessemer pig has been stationary at $18, valley furnace, and $18.65, Pittsburg. The associated valley furnaces have practically nothing to sell for this year's delivery since the sale of 20,000 tons to the American Steel & Wire Co., which does not supply all the concern's requirements for the balance of the year. There have been sales during the week of a few lots of some thousands of tons each by outside furnaces. Douglass Furnace at Sharpsville has just been blown in. It is a general belief that most of the leading steel producers are not too well fixed in the matter of pig iron for the balance of the year. In foundry and forge irons there has been only a very light demand, but with the present condition of furnaces this has been sufficient to swing the balance, and still fancier prices have been asked and paid. Buyers fully realize the delicacy of the position and are purchasing nothing but what they absolutely need. The Southern furnaces are practically out of the market. We advance all grades of foundry iron 50 cents a ton this week, making No. 2 $17, Pittsburg, but note at the same time that higher prices than these have been paid. In gray forge we note sales at $16 and $16.25, Pittsburg, for standard irons, and a sale at $16.10 for a lot of off iron particularly high in sulphur. We quote as follows:

Bessemer, valley furnace	$18.00
Bessemer, Pittsburg	18 65
No. 1 Foundry	17.25 to 17.50
No. 2 Foundry	17.00 to 17.25
No. 3 Foundry	16.50 to 16.75
Gray Forge, valley furnace	15 50 to 15.75
Gray Forge, Pittsburg	16.00 to 16.25

STEEL.—The steel market is very quiet. Transactions have been but of small volume for the double reason that enquiry is comparatively light and producers have next to nothing to sell. A fairly important part of the market has been the re-selling of steel by producers and others. Nothing below $31 can be done, and $32 has been paid for moderate sized lots of Bessemer. Open-hearth steel is unquotable. As high as $40 has been paid in an exceptional case. Odd sales of sheet bars have been made as high as $34.

FERRO-MANGANESE.—The bottom price on ferro for large lots is $85, with considerably higher prices quoted for small quantities

RAILS AND TRACK MATERIAL.—A new price has been put on rails, from $28 to $30 for standard rails, 25 pounds and upwards, according to quantity. The mills stand ready to book only such tonnage as the exigency of the case requires, the billets and other outlets for ingot capacity being forced to the utmost. In the face of any important inquiry for rails the price will doubtless be advanced so that rails will sell at least on a parity with billets. In track material we note no change, and repeat former quotations as follows: Spikes, 1.90c to 2c; track bolts, 2.30c to 2.45c; splice bars, 1.75c to 1.90c; links and pins, 2c to 2.15c.

BARS.—Both steel and iron bars are higher in price and hard to get for reasonably prompt deliveries. We quote steel bars now at 2c to 2.10c, and iron bars at 1.80c to 1.90c.

STRUCTURAL MATERIAL.—There is no further change in the structural market since the advance of $5 a ton noted last week. There is a fair running demand for small lots. We repeat quotations: Beams and channels, 3 to 15 inches, 1.75c; 18 to 24 inches, 1.85c; tees, 1.80c; zees, 1.80c; and angles, 1.75c. Universal mill plates, 2.25c.

PLATES.—The plate market is decidedly firmer, and we quote tank $2 a ton higher with shell and flange $1 a ton higher. A sale of 2,000 tons of tank plate is reported at 3c for special delivery. The Soho plate mill is being started by Jones & Laughlins this week. It will have a capacity of 200 tons a day. Quotations follow: Tank, 2.35c; shell, 2.40c; flange, 2.50c; fire box, 3¼c to 3¾c.

PIPES AND TUBES.—Late last week an advance was agreed upon for merchant pipe by the individual manufacturers in the same manner that former changes in prices have been made. The National Tube Co. is still engaged in examining titles and settling up other details, and is doing nothing with the execution of the business of the mills. The directors have not met since the meeting some time ago to elect officers. The advance in pipe amounts to exactly 25 per cent on the advanced figue quoted last week, which was 60 and two 10's, as against 60 and three 10's formerly quoted, and was made by reducing the base discount from 60 to 50. No change in casing or boiler tubes was made. We now quote as follows: Base discount, 50 per cent and additional discounts two 10's for less than carloads and two 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casing, 45 for screw and socket joint and 40 for inserted joint, with 5 per cent additional on carload orders; boiler tubes, 1¼ to 1½-inch, 40 per cent; 1¾ to 2½-inch, 50 for iron and 55 for steel; 2¾ to 6-inch, 55 for iron and 57½ for steel; extra 5 per cent to dealers.

SHEETS.—The consolidation of the sheet mills has been deferred mainly on account of the vacation being taken by Judge Moore. Active work on it will not be resumed until September, and it may be October 1 or even later before the company to be formed takes charge of the business. A conference is being held here to-day over the wage scale to govern Amalgamated wages in the mills for the year beginning July 1. The market is rather quiet, but prices are very firm. For No. 28 common 3c has been paid for round lots and this figure could not be shaded below 2.95c. Galvanized is generally quoted at 70 and 5 off, but as low as 70 and 10 might be done for desirable orders.

SPELTER.—The spelter market is still weaker than at last report, and is quoted at 6.30c, Pittsburg, and 6.40c, New York.

OLD MATERIAL.—The whole scrap market is firmer in tone and in a number of lines we note considerably higher figures. The general strength of the market justifies manufacturers in paying considerably higher prices for scrap. We now quote as follows: New melting stock, $14 to $15; old steel rails, long lengths, $14 to $15; cut, $14 to $14.50; old iron rails, $18.50 to $19; wrought iron scrap, $14 to $15; cast borings, $9 to $9.50, net, Pittsburg; busheling scrap, $12.50 to $13, net; car wheels (nominal), $14 to $14.50, gross; cast scrap, $12.50 to $13, gross; charcoal scrap, $13, gross; wrought turnings, $8.50 to $9, net, Pittsburg.

COKE.—The coke market is still higher, and strictly Connellsville furnace coke cannot be secured below $2.25, with a fair run of business for the time of the year. In foundry and crushed we still quote Connellsville at $2.15 to dealers and $2.30 to consummers.

CHICAGO.

Office of The Iron Trade Review and Industrial World.
1522 MONADNOCK BLOCK, June 13.

Activity to a feverish degree is the most noticeable feature of the western iron and steel markets. There is persistent buying in almost all branches of the trade, not in any phenominally large amounts, but in a steady stream of moderately sized orders. The call for material is in excess of the producers' output, and there is trouble all around in making the sales and deliveries asked for. Prices are notably higher than a week ago. Steel rails have advanced to $30, standard sections; rods are quoted $42, pig iron is about $1 higher, and in those products that have scored no additional advance this week prices are ruling very firm. The condition of the

market is such that experienced factors see no immediate relief. And when it comes it is likely to be through forcing values to that excessive level that stops consumption and in turn brings a drop in prices. Present demand is as keen as it has been perhaps at any time in the current upward movement.

PIG IRON.—All grades of pig iron are about a dollar higher than a week ago. The advance has come steadily and slowly, a little each day, and there is considerable irregularity in values. The Southern situation has been complicated by the announced advance in the rail rates from the furnaces to Chicago, of 50 cents per ton, effective June 19, or from $3.50 to $4 per ton. This is to be supplemented by another advance of 15 cents, effective July 1, making the freight rate on that date $4.15, which is the highest the Southern product has ever paid to this market. No. 2 Southern foundry is generally quoted here at $17.50 but prices of some furnacemen are withdrawn, even at that figure. There has been good inquiry for Northern iron and a fair number of contracts have been closed, including about 18,000 tons of malleable iron. The Minerva Furnace at Milwaukee blew in on Friday last week, and is now turning out about 125 tons of foundry per day. There are no stocks in this territory and great difficulty is experienced in keeping the foundries supplied with material. Revised quotations are as follows:

Lake Sup. Charcoal	$19 00	$20 00	
Local Coke Fdy. No. 1	17 50 @	18 00	
Local Coke Fdy. No. 2	17 00 @	17 50	
Local Coke Fdy. No. 3	16 50 @	17 00	
Local Scotch Fdy. No. 1	18 00 @	18 50	
Local Scotch Fdy. No. 2	16 50 @	17 00	
Local Scotch Fdy. No. 3	16 00 @	16 50	
Southern Coke No. 1	17 50 @	17 75	
Southern Coke No. 2	17 00 @	17 25	
Southern Coke No. 3	$16 50 @	$16 75	
Southern No. 1 Soft	17 50 @	17 75	
Southern No. 2 Soft	17 00 @	17 25	
Southern Silveries	17 50 @	17 75	
Jackson Co. Silveries	20 00 @	21 00	
Ohio Strong Softeners	20 00 @	21 00	
Alabama Car Wheel	19 50 @	20 00	
Malleable Bessemer	18 50 @	19 00	
Coke Bessemer	19 00 @	19 50	

BARS.—For steel bars 2c is the leading quotation, but some makers are quoting considerably higher. Iron bars are quoted about 1.80c to 1.90c, but there is not complete uniformity. Trade is of a satisfactory character generally. The agricultural implement makers are in the market for considerable material of one sort or another and are picking up quite a tonnage. It is mainly for next season's needs. Some of the implement works are reducing their present output in consequence of the reports of crop damage but they are evidently buying for future needs under the impression that the market promises continued strength.

STRUCTURAL MATERIAL.—Demand for shapes continues uninterruptedly, despite the sharp advance in prices last week. Perhaps the largest purchase was for about 1,500 tons of channels from a car works, but the miscellaneous trade is very fair. We quote as follows: Beams, 15 inches and under, 1.90c to 2c; 18 inches and over, 2c to 2.10c; angles under 3 inches and over 6 inches, 2c to 2.10c; 3 inches to 6 inches, 1.90c to 2c; sheared plates, 2.65c to 2.70c; universal plates, 2.65c; tees, 1.95c to 2c; zees, 1.95c to 2c. Small lots from store are quoted ¼c to ½c higher.

PLATES.—Trade is limited by the scant abilities of producers to fill current needs. For spot material there has been demand and boiler makers and other users continue to lament the dearth of plates, which they say is seriously interfering with their work. While nominally prices are unchanged, this must be qualified with the remark that for quick shipment premiums on circular prices are easily obtainable. Tank steel from stock is quoted 2.75c to 3c. Mill shipments, Chicago delivery, are quoted as follows: Tank steel, 2.65c; shell, 2.75c; flange, 2.85c; marine, 2.95c; fire box, 3c to 5c, according to brand.

MERCHANT PIPE.—Steel pipe is much higher. It is now quoted 50, two 10's and 5 per cent discount. Tubes have also been marked up about 10 per cent during the past week.

SHEETS.—Nominally there is little change in the sheet market but the tone is very strong. There is less irrgularity in prices and the usual quotation is about 70 and 5 from mill and 70 from store. Black sheets are in fair demand and prices are firm at 3c to 3.15c for No. 27.

MERCHANT STEEL.—Values are well maintained at the recent advances. A noticeable improvement in the buying has intervened and some of the larger consumers are in the market for their wants during the ensuing season; others have already covered their coming needs. We quote smooth finish tire steel, 2.35c to 2.45c; smooth finish machinery steel, 2.55c to 2.65c; spring steel, 2.80c to 2.90c; tool steel, 6c to 7.50c; special, 10c and upwards.

BILLETS AND RODS.—No sales of billets are reported this week. Rods are higher and are selling at about $42. There is a good demand for future delivery.

RAILS AND TRACK SUPPLIES.—For such deliveries as can be made, sales of standard rails have been very fair. But the demand is in excess of the ability of mills to fill. Prices have been advanced and standard rails are now quoted at $30 to $32; light rails, $32 to $37. Splice bars are 1 70c to 1.75c; spikes, 2.25c to 2.35c; track bolts, 2.85c to 3.25c.

OLD MATERIAL.—The market seems to have settled down for the present to a steady trade at a steadier range of values than has been seen for some time. We quote dealers' selling prices, as follows:

Old iron rails, gross	$17 75 @	$18 00	
Old steel rails, long, gr.	13 00 @	13 50	
Old steel rails, mixed	12 00 @	12 50	
Old wheels, gross	15 00 @	16 00	
Railroad forge, net	15 50 @	16 50	
Dealer's forge, net	12 00 @	12 50	
No. 1 mill, net	8 75 @	9 25	
Heavy cast, net	10 50 @	11 00	
Malleable cast, net	8 00 @	8 50	
Axles, net	$18 00 @	$19 00	
Cast borings, net	6 00 @	6 50	
Wrought turnings, net	8 50 @	9 00	
Axle turnings, net	9 00 @	9 50	
Mixed steel, gross		8 50	
Stove plates, net	7 00 @	7 50	
Heavy melting steel, gr.	11 00 @	12 00	
Old iron splice b., net	17 50 @	18 00	

WIRE AND WIRE NAILS.—There is continued good buying of nails, and while in barb wire some decrease has appeared, the trade is pronounced the best that has been seen at this season of the year in many seasons. Wire nails are now quoted at $2.60, f. o. b. Chicago, in car lots, and $2.70 less than car lots. On wire current quotations are as follows: Plain annealed wire, $2.45; painted barb wire at $2.70; galvanized barb wire, $3.20.

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World*, 27 VINCENT ST., June 14.

Ore shippers have been not a little surprised at the total movement from upper lake ports in May, in view of the late opening and the interruption caused by the grain handlers' and dock men's strike at Buffalo. To June 1, this year, the total of ore moved is 2,120,067 gross tons, as compared with 2,334,039 gross tons to June 1, 1898, a falling off of only 214,000 tons. Last year's figures, as is well known, include considerable ore moved in April, while this year only a very small start was made from Escanaba in April. The deadlock between coal shippers and vessel men causing ore boats to go up light accounts for a part of the big ore movement this year; and another factor is the improved despatch boats have had both at Lake Erie and upper lake ports. A beginning has now been made in the coal trade and this will give a relatively less ore movement. Good cargoes are being carried by all ore boats, generally larger than last year's, and this, with the speedy trips that have been the rule, thus far, promises to make June the banner month in ore carrying. Deals in Lake Superior mines are still a factor of importance, and owners of properties new and old find little difficulty in interesting leading companies at least to the extent of an examination. Half of a large Mesabi property not yet a producer has changed hands recently, and there is a revival of rumor concerning Marquette range interests thus far unidentified with ore consumers.

PIG IRON.—The scarcity of Bessemer pig is being accented. Efforts of steel works to hurry forward small arrearages on existing contracts with furnaces tell their own story of the inadequacy of current shipments to meet the requirements of such plants, outside of their own production. It is becoming evident that every important producer of steel in the Central West will need more iron than can be furnished in the next six months. Sales have been made, but none of round lots, in the past week at $18 in the valley. Stocks have been reduced in the past month, both of Bessemer and foundry grades. No. 2 foundry has sold at $18, valley furnace, the past week, but lower prices rule in current transactions. Among foundries generally a shortage of Southern softeners and of Northern high silicon irons is particularly complained of, and instances of hardships through insufficient shipments and through compulsory changes in mixtures are beginning to be reported. Furnaces are being besieged to make sales that would cut down the small reserve of probable production in the balance of 1899, that has been maintained as a guarantee that buyers already covered would get their iron according to specified deliveries. It is believed, from the number and tonnage of inquiries still coming in for 1899 delivery, that the production of the furnaces will not meet the requirements of foundries, taking for granted that the latter are seeking iron

for castings either contracted for or that they know will be needed before the end of the year. Requirements of forge iron for this year are far from being covered and yet very little comparatively can yet be sold either North or South, for delivery before January. We quote $15.50 to $16, valley furnace. Cleveland quotations are:

Bessemer	$18 65	Valley Scotch No. 1	$17 75@18 75
No. 1 Strong Foundry	17 75@18 75	Valley Scotch No. 2	17 50@18 50
No. 2 Strong Foundry	17 50@18 50	Gray Forge, valley	16 00@16 50
No. 3 Foundry	16 75@17 25	Lake Superior Charcoal	19 00@20 00

FINISHED MATERIAL.—The feature of the demand in rolled material is the call for structural shapes. Northern Ohio bridge works have taken drainage canal and Buffalo viaduct contracts and have covered for material. The structural demand, moreover, has increased in all lines, and mills that were booked four weeks ahead are now filled for seven or eight weeks. This line heretofore has not shown the pressure evident in plates and bars, for example, but it is rapidly getting into like shape. There is rather an increase of business in all finished lines as the season advances. Jobbers are getting business which the mills cannot handle. This is noticeable in merchant pipe. Mill prices have advanced to a basis of 50, two 10's and 5, but in few cases can deliveries be guaranteed short of fall, and on material out of stock 50 and 10 is the quotation. There is an especially good run of orders in heavy sheets, particularly from Nos. 10 to 14. The Cleveland quotation out of stock is 3.20c for No. 27; from mill in carload lots, 2.90c to 2.95c. Bar iron is active and the quotations are maintained at 1.70c, Youngstown mill, in carload lots; 1.85c in less. Cleveland sales are made at 1.90c out of stock. Steel bars are selling at 2 10c, Pittsburg mill. December deliveries are the earliest possible on smaller sizes. The plates for the four 500-foot vessels let last week went to Chicago and Cleveland mills under options taken some weeks ago.

WIRE AND WIRE NAILS.—Shipments are very heavy. Jobbers note an unusually large demand for barb wire. Shipments of smooth wire are also very large. In both lines the mills are pressed for deliveries. We quote plain annealed wire $2.20, Pittsburg, in carload lots to jobbers, freight to Cleveland added for local delivery. Painted barb wire is sold at $2.45 carload lots and galvanized at $2.95. We quote wire nails at the advance noted last week, $2.35, Pittsburg, carload lots to jobbers.

OLD MATERIAL.—The market is strong, with advances on some materials. No considerable purchases by the Republic Iron & Steel Co. are reported in addition to the round lots taken at the start. Heavy steel scrap is higher, and we quote $15 to $16 for old steel rails, delivered at mill; old iron rails, $19.50 to $20; No. 1 railroad wrought scrap, $16.50 to $17.50; busheling scrap, $13 to $14; cast borings, $9; machinery cast scrap, $12.50; old car wheels, $16.

CINCINNATI.

June 13.

The main event during the past week was the announcement that the railroads south of the Ohio river intended on the 21st to advance freight rates 50 cents a ton. This will make a total advance of $1 a ton since the better market began. No warning was given of the advance. The furnaces were notified on the 11th and no opportunity was given to protect the old rate on sales between that date and the 21st. A great deal of iron was sold last week and there was considerable irregularity in prices. Gray forge ranging from $11.75 to $12.50, Birmingham. It is too early now to say what effect this advance will have on the market. It may start an extensive buying movement or else stop sales altogether. But as the Southern furnaces are for the most part badly oversold, there is not much more iron to be had for love or money. There is still an insistent demand for soft foundry irons, and these are not to be secured, the shortage being painfully apparent. A number of Northern and Eastern furnaces have been obliged to withdraw from the market during the past week on account of their oversold condition. It seems impossible now to to obtain any Ohio foundry irons for early delivery and the situation in the South is not much better. We have advanced quotations below to correspond as nearly as possible with present range of prices, cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $16.75 to 17.25; No. 2, $16 to $16.50; No. 3, $15.25 to $15.50; No. 4 and gray forge, $14.75 to $15; mottled, $14.75 to $15; No. 1 soft, $16.75 to $17.25; No. 2 soft, $16 to $16.50; Lake Superior coke, No. 1, $18 to $18.50; No. 2, $17.50 to $18; Hanging Rock charcoal No. 1, $20 to $22; Jackson Co. silvery No. 1, $21 to $22; Standard Georgia car wheel, $17 to $18; Lake Superior charcoal, $20.50 to $21.

Tin House Wage Scale Signed.

At the conference last week in Chicago between representatives of the American Tin Plate Co. and of the Tin Plate Workers' International Protective Association a scale of wages was agreed upon to govern wages in the tin houses of the company throughout the country, for the year beginning July 1. The wages thus fixed have been heretofore a matter for individual adjustment except that in one or two mills scales had been adopted which governed those particular tin houses. Besides the point gained in adding another branch of industry to those in which wages are uniform throughout the country, from the efforts of organized labor, the tin house scale adopted brings larger or smaller advances to all the workmen. There was a great variety in the wages paid for this class of work in the different plants, so that the advances are far from uniform. The company operates on an average about 450 tinning sets, and the total number of operatives coming under the new scale amounts to several thousand.

The most important provision in the scale is the paragraph relating to work on the double stack and 8-roll standard and 10-roll Thomas & White machines, on which the tinman is to receive 5 cents a box and the catcher 3½ cents, for "large plates," and the tinman 5½ cents and the catcher 3¼ cents for "small plates." Large plates are those 400 square inches in area or larger. The most common size is 20x28, containing 560 square inches, and the great bulk of the tinning will therefore be controlled by the rates for "large plates." The rates are paid for the standard box, containing plates having an aggregate area of 31,360 square inches, and the men are therefore paid by the area of plates tinned as a unit, and not by the weight or number of sheets. Tinners will receive on Jumbo stocks, 5 cents per box, and risers 3 cents per box for all plates occupying over 32 inches of the rolls. For all plates occupying 32 inches of the rolls and under, tinners shall receive 6 cents, and risers, or catchers, 4 cents per box.

On general labor the following clauses were adopted: Where the rate paid prior to January 1, 1899, was $1.50 per day, or less, the new rate shall be 15 per cent higher. Where the rate was from $1.50 to $2 per day the rate shall be 12½ per cent higher. Where the rate was from $2 to $2.50 per day the rate shall be 10 per cent higher. In view of the fact that some advances have been granted since January 1, 1899, the prices to be paid after July 1 are not to be figured on present prices, but are to be figured on prices paid prior to January 1, 1899. Eight hours to constitute a day's work.

ORE properties long unworked are being brought in line, in view of the expansion of pig iron production in all furnace districts of the country. A dispatch from Rockaway, N. J., gives the following concerning some practically forgotten Jersey ore pits: "There has been a great revival in the iron ore industry in Morris county. Mines are starting up all through the mining districts. Joseph Wharton, of Philadelpha, who recently purchased the interests of the Glendon Iron Co., is pumping out the Wood mines preparatory to resuming operations. The Beach Glen Iron Co. has resumed operations and is running on full time. It is also stated that the old Orchard mine at Port Oram, which was abandoned years ago on account of the low price of ore, will resume operations in a short time. Green Pond mine, which was recently purchased by the Cartaret Steel Co., will, it is said, be the scene of renewed activity soon. The mine has already been pumped out. The Thomas Iron Co. is making extensive improvements at the Richard mine to increase its capaciy of turning out ore. Merrill & Jacobs, of New York, have begun operations at the Weldon mine. It is reported also that the Mount Hope mine will resume operations in a very short time."

MANUFACTURERS of farm machinery at a meeting in Chicago decided to advance prices, and committees on schedule have been appointed. It is expected the advances will be from 15 to 25 per cent.

PERSONAL.

John Williams, Jr., of Nettlefords, Ltd., Newport, Mon., England, has been spending the past week in Cleveland and Pittsburg. Mr. Williams has contracted with Wm Garrett for the erection of a Garrett rod mill at Newport. As president of the Newport Cushion Tire Co., he has been looking for a manufacturing site in this country.

S. V. Huber, who for some time past has been chief engineer for the Lloyd, Booth Co., Youngstown, O., has resigned to associate himself with H. E. Schild, formerly chief engineer for the Colorado Fuel & Iron Co., Pueblo, Col., to carry on general metallurgical engineering work under the name of S. V. Huber & Co.

Percy A. Summers, of Youngstown, O., has been made office manager of the Cherry Valley plant of the Republic Iron & Steel Co., at Leetonia, O.

Charles F. Thompson, wellknown as the secretary and treasurer of the Lane & Bodley Co., of Cincinnati, has resigned and will retire from office July 1. Mr. Thompson has been connected with the company for 35 years. He has not made a new connection and his successor has not been named.

James H. Nutt, of Youngstown, O., secretary of the Iron Manufacturers' Association, was stricken by the heat June 12 and his condition was considered serious.

David E. Park, of the Park Steel Co., which recently succeeded Park, Brother & Co., has taken a large interest in the business of Spang, Chalfant & Co., Pittsburg, and the firm will be reorganized into a Pennsylvania corporation. The plant of the concern will be remodeled and enlarged. The plans are now under discussion.

E. Sheil, formerly a heater in the Pittsburg works at New Kensington, of the American Tin Plate Co., has been made manager of the company's Star mill in Pittsburg.

Dr. Wm. B. Phillips, editor of the *American Manufacturer*, has notified President Seaman, of the American Foundrymen's Association, of his unwillingness to be considered in connection with the secretaryship of the American Foudrymen's Association, though it was informally announced at the Pittsburg convention that he would accept. Secretary John A. Penton has been asked by the officers of the association to withdraw his resignation, and it will be greatly to the interest of the organization if Mr. Penton can arrange his duties so as to continue in the work.

A. J. Moxham and his family sail from Southampton in the Moxham yacht, the Elf King, about June 20. The party will cruise up the coast of Norway in the summer, and expect to return to the United States in October.

Samuel S. Wales, for several years chief electrician at the Ohio plant of the National Steel Co., Youngstown, O., has accepted a similar position at the Homestead works of the Carnegie Steel Co. He is succeeded at Youngstown by B. R. Shofer.

Obituary.

A shock came to a large circle of friends with the announcement of the death on Monday, June 12, of Chas. A. Bauer, general manager of the Warder, Bushnell & Glessner Co., Springfield, O. Mr. Bauer had submitted to an operation involving abdominal cision and did not rally. He was active in business almost to the day of his death. On Monday and Tuesday, June 5 and 6, he attended the conference in Cleveland of committees of the National Founders' Association and the Iron Molders' Union of North America. For more than a year he had been vice-president for the Central Western States of the American Foundrymen's Association and took an active interest in its upbuilding. As general manager of the great mower and reaper works at Springfield he showed conspicuous ability for industrial management and his supervision was an important element in the success of the concern. Besides being prominent in the two foundrymen's associations, Mr. Bauer was a member of the American Society of Mechanical Engineers. Governor Bushnell, of Ohio, appointed him one of the four members of the Ohio State House Commission, which was charged with the rebuilding of the State House at Columbus—an unfinished work in which he rendered conspicuous service.

Mr. Bauer was 55 years old. He is survived by his wife and four children. One of the latter, C. A. Bauer, was associated with his father in the mechanical department of the Springfield works.

LAKE SUPERIOR IRON MINES.

P. L. Kimberly and J. T. Jones, who developed the Biwabic property, are carrying on exploratory work on the west end of the Mesabi range and are opening the Jones forty close to the Franklin mine, machinery having been put in recently.

The American Steel & Wire Co.'s lease of the Alpena property adjoining the Sauntry, is on a royalty of 15 cents on a minimum basis of 100,000 tons a year. There has been proved up 2,500,000 tons of ore.

The Cleveland-Cliffs Iron Co. has been inspecting the Imperial mine, near Michigamme, and has decided to re-open the property. It will be unwatered and worked this summer.

A. B. Miner, of Ishpeming, for himself and associates, has purchased the old Goodrich mine at Saginaw, Marquette county, Mich. The mine was active a good many years ago, shipping 49,754 tons of hard ore in all, the last year's shipments being 9,998 tons in 1882. There is also a soft hematite on the property and it is the purpose to develop this.

The Davis mine, which Ironwood, Mich., parties are taking hold of, is attracting attention for a body of manganiferous ore. The surface is being stripped; a shaft has been sunk also.

S. S. Curry has an option on a Gogebic property, the Bourne, west of the Montreal river.

The Michigan mine at Amasa is being unwatered and 25 men are at work proving up the ore body.

Lazarus Silverman, of Chicago, and associates have leased to the Pittsburg & Lake Angeline Iron Co. 760 acres of iron property in sections 25 and 26, 63-12, Vermillion range. The lands lie east of the Savoy mine of the Oliver Iron Mining Co. They are now being explored thoroughly. It is stated that when these properties come to be worked the water power about three miles distant will be developed and power conveyed by electricity for mining operations. In addition to these Vermillion lands the Lake Angeline Co. has leased from the same parties lands in sections 1, 11 and 12, 59-14. A spur of the Iron Range road five miles long will be built to these.

Molders' Vote on Foundry Arbitration.

In its June issue the *Iron Molders' Journal* gives the result of the vote of the union molders on ratifying the arbitration agreement between officers of the National Founders' Association and the Iron Molders' Union of North America. The *Journal* says that while the vote "is, like every referendum vote taken in our organization, very small, comprising only about one-fourth of our membership, it is gratifyingly favorable to ratification." Of the 5,644 members voting, 4,524 favored and only 1,120 opposed the arbitration proposition. It may be recalled that the features of the agreement are these: In case of a dispute between employer and employes, members respectively of the two organizations, an effort shall be made by those immediately in interest to adjust it. Failing this, either side may ask the reference of the matter to a committee consisting of the presidents of the two associations and two other representatives of each, appointed by the presidents. The finding of this committee of arbitration is to be final and pending a decision there shall be no cessation of work.

The *Iron Molders' Journal* says: "Our members have had a long and bitter experience of the costliness of strikes, and the bitter feelings they arouse, and have shown their wisdom in indorsing an agreement which seeks to minimize them and provide a more modern, more just, and more satisfactory way of settling disputes. The proper carrying out of this agreement entails a greater regard for discipline among the rank and file. Arbitration means arbitration not only of other people's quarrels, but of our own, and when the dispute arises in our midst, our passions and impulses must not be permitted to sway us and tempt us to lose sight of the principle we have so overwhelmingly indorsed."

A LONDON cablegram of June 11, says: "A company has been formed with a capital of £30,000 to ascertain whether steel can be cast in a vacuum. If the plan is successful the air bubbles that now cause flaws and weakness will be done away with and a much stronger metal will result." A process for casting steel in small ingots in the absence of air is covered in the United States by patents taken out some time ago by John A. Potter, formerly manager of the Cleveland Steel Co.

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AND
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B. M. GARDNER, Associate Editor and Western Manager.

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THE CONSOLIDATION MOVEMENT CHECKED.

Just as the feeling of apprehension at the rapid launching of consolidations had reached the acute stage, events came to the rescue. The stock exchange trading in these securities, which has been considered one of the objectionable features of the consolidation regime has really proved the saftey valve.. While it is perfectly evident that the declines following Gov. Flower's death carried some stocks to unreasonably low levels, the net result of the downward movement has been salutary. Sales in the market at figures below those at which stocks were underwritten by bankers have been no uncommon thing. It is even said that this has happened in the case of more than half the securities floated since February. While recovery from these low points has been the rule, it has been in no case rapid; and the bull features of the stock market are not so numerous as to tempt the outside public to take a hand to any extent. Naturally underwriting syndicates are not readily interested in new ventures. Some very meritorious enterprises in iron and steel, for example, are now hanging between heaven and earth, because they happened to come up a few weeks after the consolidation craze had reached its height. It is evident that some plans in these lines will either be laid aside permanently, or will be carried through on a basis that will require very little outside capital. And as there will be no particular incentive to the heads of good concerns to put their plants into a pool and get in return only stock in a new company in the conduct of which they will have little voice, it is entirely probable that the promoter's occupation for some time to come will not be as lucrative as it has been in the opening months of 1899. And where options have been taken at good round figures, it may turn out that the privilege of attempting to "assemble" industry has been very dearly bought.

Outside of those whose pecuniary interest would have been advanced by the putting through of pending deals, we believe there will be satisafction at the check thus given to the manufacture of "industrials." While it is true that those immediately connected with them would be the chief sufferers from any collapse that might come, it is also true that the general unsettling of confidence that such a catastrophe would bring would be a serious interruption to the current of prosperity that is now so strong. The speculative fever evidenced in the organization of some very vicious schemes, the securities of which, with little to back them but promises and plausible prospectuses, have a quoted value in the East, and are passing from hand to hand, has been without doubt a serious menace even to such well-grounded prosperity as to-day's.

So far as the iron trade is concerned, its consolidations, with one or two exceptions, are strong, excellently managed and can fulfill reasonable dividend expectations. But even with this much said, it is time to give the digestive process a chance.

STRONG IRON MARKETS ABROAD.

In some of the predictions of speedy reaction in iron and steel prices in the United States there has been a failure to take account of the great strength of the iron markets abroad. Speculation in British markets, added to the legitimate strength of the situation, sent Middlesboro and Scotch warrants up nearly $3 a ton in two months. In the week ending June 2 the advance in foundry and Bessemer warrants in British markets was 75 cents a ton. And the foreign demand for American iron, particularly from Continental Europe, has kept up in a surprising way. It is to be considered that there is at present a greater world consumption of iron than in any period, and that the world's facilities for production are being overtaxed. So far as the United States is concerned it is well known that months will be required to make such additions to effective capacity as will turn the scale, and months more, after production overtakes consumption, for any such stocks of iron to accumulate as were held one year ago. Of the general market conditions in British consuming centers the *London Iron and Coal Trades Review* says in its issue of June 2:

Demand for manufactured iron is strong, while all branches of the steel industry are fully employed, and the high prices recently prevailing are not only fully maintained, but a hardening tendency is noticeable in some districts notwithstanding that the amount of new work coming forward has in some cases shown a slight falling off. Engineers are wel supplied with work, and the shipbuilding industry is likewise active, particularly in Belfast, at which center it is stated that ten of the largest vessels in the world, representing 100,000 tons, are being fitted up or overhauled. The Middlesbrough market has again been disturbed this week, and prices have been forced up considerably for warrants. The effect has been, as usual, to check business, the price of warrants having touched 59s. 8d., or 3s. higher than last week. In and around Barrow the demand for hematite is stronger than ever, with the result that prices have increased, and as much as 69s. per ton can now be obtained for mixed numbers of Bessemer. A fair business has been done on the Lancashire market, but there is very little iron to be disposed of, and the anxiety evinced by customers who in view of the recent increase in prices are anxious to place contracts is not likely to be satisfied, as quotations are hardening rapidly.

On the Continent complaints are rife concerning the scarcity of fuel experienced, which is seriously hampering metallurgical industries, which would otherwise be in an exceedingly prosperous condition. Numerous new trade undertakings are projected in Belgium, capital seeking an outlet in Russia and elsewhere.

THE SHORTENING OF CREDITS.

The reforms of credits which some of the iron and steel consolidations are introducing are a contribution to the good of the trade at large, though started with no such benevolent intention. In 1893 and 1894 there was some very sober moralizing abroad, as to the bad habits into which the iron trade had fallen in the matter of credits. It was admitted that one element in the depression was the folly of producers in granting three months, four months and even longer time on purchases; and three were many resolutions registered, looking to a shortening of credits. Many houses that found it impossible to turn about in time of need, because their books were loaded with accounts, many of them with customers tempted by offers of long accommodation, vowed that if they weathered that storm they would shorten sail and keep closer to the wind. But the serious intentions of panic times did not survive long with those who entertained them, and the era of large consolidations finds the trade greatly needing the services of a few men with the intelligence and the backbone to change long-standing credit customs. And one after another the consolidations are being heard from. Cash in 30 days is more and more the rule. In one notable instance the cash discount has been abolished. For the moment the proceeding may be regarded as an arbitrary use of power. As a matter of fact it is the termination of a long period of credit abuses, that have added peril to the hardships that have been the common lot of iron and steel manufacturers. There may be some particulars in which the consolidations are not a pattern for the trade at large. In this much needed reform they can be followed with profit by manufacturer and jobber in every line. Years like the present one should be made times for gaining the ground lost in the long retrograde movement ended in 1898.

GROWING EXPORTS OF WIRE AND WIRE NAILS.

The figures for wire and wire nail exports in recent months are an indication of the possibilities of expansion in iron and steel exports through strong corporations, controlling raw materials. The American Steel & Wire Co., owning iron mines and ore carrying fleet, and secure against fluctuation in fuel, in respect to a part of its supply, at least, is able to sell wire and nails at a profit year in and year out, in competition with manufacturers in any part of the world. Just now conditions abroad are such, owing to world-wide advances in iron and steel, that a good profit is possible on wire and wire nail exports. This does not mean that the export trade yields any such profit as the home market under the recent advances in wire products. But with all the advances in labor and in raw materials in the United States, foreign markets are being cultivated steadily by the company named and its trade abroad has been increasing rapidly month by month as compared with the months of 1898.

The April statement of the Treasury Department shows that in wire 22,409,718 pounds, valued at $418,801, was exported in that month, while in April, 1898, the total was only 10,312,695 pounds, valued at $206,188. In the ten months ending with April the wire exports were 169,266,848 pounds, against 100,728,651 in the ten months ending April 30, 1898, and 87,334,222 pounds in the ten months ending April 30, 1897.

The April exhibit of wire nail exports shows that the tonnage of April, 1898, was quadrupled—4,449,192 pounds against 1,136,344 pounds. For the 10-month periods ending April 30, 1899, 1898, and 1897 the total exports of wire nails were 37,341,549 pounds, 18,645,253 pounds, and 8,394,719 pounds respectively, a marvelous record of increase.

The policy of the American Steel & Wire Co., announced at the beginning of its career, to make large extensions of its foreign trade, has been adhered to, in the face of the rapid advances in all products in the home market. Knowing what its cost will be, within certain narrow limits, over a period of years, it is possible for such a company to lay out its programme for the export trade and adhere to it, whatever happens at home. With a boom in the home trade, its facilities of production are such that its shipments abroad need not be interrupted; and when trade is slack at home it is in position to push with unusual energy for the trade of foreign consumers. This condition, which is one strong feature of the consolidation regime in the American iron trade, is a prime guarantee against any such low-level prices as ruled in 1893 and the three years following.

The Iron Wage Scale Fixed.

The puddling and finishing scales were settled late last week in Detroit between representatives of the Republic Iron & Steel Co. and the American Steel Hoop Co., and representatives of the Amalgamated Association. There were also present representatives of the Bay View plant of the Illinois Steel Co., of the American Car & Foundry Co.'s Detroit mill and of the Coleman-Shields Co., Niles, O. There was some recession on the part of the workers from the original demand formulated at the convention, but still the advance in wages decided on is a very important one. The old puddling scale was based on $4 for puddling on a one-cent card, with 25 cents advance for each tenth cent. The convention demanded $5 on a 1.3-cent card but the conclusion of the conference was on a basis of $5 on a 1.4 cent card. This raises the minimum by $1, but further wage advances will not begin so soon. With bar iron at 1.4 cents puddlers will receive $5, as under the former scale. The demand of the recent Detroit convention would have given $5.25 for puddling when bar iron sold for 1.4c. The effect of the settlement is to give a puddling rate for the coming year 25 cents less than it probably would have been had the scale been taken as originally presented. The price for muck rolling is made one-seventh instead of one-eighth the price for boiling, and a straight advance of 25 per cent is made to the finishers, with 1.4c bar iron as the base.

The only thing that remains unsettled is the clause which provides that all men affected by the scale should be members of the Amalgamated Association. This clause, after being modified, was held in abeyance until after the conference of the sheet and tin plate concerns, as the amalgamated association wishes to present it to them also.

THE sale of the New Castle Engineering Works, New Castle, Pa., on June 7, was on the petition of the second mortgage bond holders and Geo. B. Herenden, of Wilmette, Ill., and Willis L. King, representing the petitioners, bid in the property with the intention of disposing of it at private sale.

THE PITTSBURG DISTRICT.

A new blooming mill will be installed by the American Steel & Wire Co., at the Shoenberger plant at Pittsburg. This will double the output, increasing it to 1,000 tons a day

The American Steel Hoop Co.'s three stacks of the Isabella Furnace Co., at Etna, Pa., will be extensively improved. Two are 75x20 ft., equipped with six 75x21 Whitwell stoves, and the other stack is 75x16, equipped with three Kennedy stoves. The daily capacity of the three stacks, now about 600 tons, will be much increased by raising the stacks, putting in new stoves, and increasing the blowing capacity. There will be as little interruption in the operation of the furnaces as is possible. The American Steel Hoop Co. also has Fannie Furnace at West Middlesex, Pa.

The Pittsburg Gage & Supply Co., 309-311 Water st., and 308-310 First ave., has had a notable increase in its business in the past few years. For 14 months its plant has been working day and night. Its specialties are all growing in favor, the list including the Pittsburg safety water columns, rotating gauge cocks, steam, vacuum and hydraulic gauges, Pittsburg oil filter, and exhaust heads. All are known under the name "Pittsburg" and shipments are made not only to important concerns at home but to the foreign trade. The company has been experimenting for some time with a new feed water regulator, and the results have been so satisfactory that it will soon be placed upon the market.

Contracts have been placed in Pittsburg for the power plant, blooming mill and other rolling mill machinery for the newly formed New York Steel & Wire Co., which will erect a complete wire plant at Astoria, Long Island. There is to be a 32-inch blooming mill, run by a reversing engine with two cylinders, 28x42 inches. The boilers will be equipped with Roney stokers and forced draft. The plant will be at tidewater, and will receive and ship material almost wholly by water. A dock 600 feet long is to be built in front of the works. There will be four 30-ton open-hearth furnaces. Besides rolling rods to be drawn into wire in the wire department, there will be a merchant bar mill.

The American Steel Hoop Co. last week posted notices at its Painter works, in Pittsburg, of an advance of about 10 per cent in wages. This mill was non-union under the individual ownership and the advance was made to bring the wages in harmony with the wages paid in the plants where organized labor is in control. The advance was voluntary on the part of the company.

Last week Jones & Laughlin, Ltd., closed all their options for coal land in the vicinity of Coal Center, Pa., and the firm now has a clear opening to all its coal lands in the third, fourth and fifth pools of the Monongahela, the coal land aggregationg over 3,000 acres. The firm has bought the surface on part of the coal land also.

Phillips, Nimick & Co., Pittsburg, are overhauling their Sligo plate mill and in a short time will have a practically new mill, with increased capacity.

C. Davis & Co., 237 Fourth ave, Pittsburg, have been identified with the trade in pipes and tubes, scrap iron and second hand machinery for the past 15 years. In the conduct of its business in old material the firm has no yard, but trades with some of the largest producers of iron and steel in the country. Its last month's business amounted to nearly 1,500 tons of scrap. In tubing and casing all sizes are kept constantly in stock

J. H. Hillman, 8 Wood st., Pittsburg, has been in the iron brokerage business for the last 14 years. Having formerly owned and managed a cold blast charcoal furnace in the South he is thoroughly familiar with the charcoal iron business, which is his special branch. He is sole agent of and controls several large charcoal furnaces and it is understood has a larger trade for cold blast iron for the making of rolls than any other firm in the United States. He makes a specialty of supplying high-class charcoal iron for chilled rolls, car wheels, malleable castings, cannon, and all work requiring iron having great strength, chilling qualities and castings requiring a minimum shrinkage.

The National Steel Co., has decided to open a branch office in Pittsburg.

Frank B. Pope, Pittsburg, general sales agent for the Savage Fire Brick Co., has been given the contract for upward of 100,000 silica brick for the new open-hearth steel plant to be erected by the Burgess Steel & Iron Co., Portsmouth, O.

THE FOUNDRYMEN'S ASSOCIATION.

While the advance in pig iron was the theme of some informal discussion at the regular meeting of the Foundrymen's Association at Philadelphia, Wednesday evening, June 7, it failed to bring about any discussion on the prices of castings. The possibility of a further advance in the price of pig iron proved of interest to the association and the majority of the members were inclined to the belief that $20 or even $25 might be reached in the present year. Among the various reasons given for continuance of the strong conditions in iron were the heavy legitimate demand, with little or no speculation, following on a period of curtailed consumption; an increasing export trade; the various new uses continually being found for iron and steel; the great number of proposed new enterprises—buildings, trolley lines, railroad extensions, shipbuilding revival, etc.; the new fields being opened up in Egypt, China, Japan and South Africa. The bringing into activity of long idle plants, and the extension of producing capacity by strong producers were mentioned as probable sources of a reaction in the trade.

A. B. Farquhar's paper on "Trade, Trusts and Tariffs" was read to the association and occupied the greater part of the session, necessitating the postponement of a description, illustrated by stereopticon, of a foundry in South Carolina. Mr. Farquhar's address, while touching on the conditions unfavorable to the iron trade, attacked the evil influences of trusts in general.

Monopolization, favored by tax laws, or practically an alliance of tariff and trusts was responsible, the speaker argued, for the present deplorable situation, and he advocated tariff modifications as the proper cure for trust evils. The machinations of these combinations would be rendered less injurious, according to Mr. Farquhar, if the monopoly features were suppressed and regulations adopted requiring greater publicity in respect to their workings; but he did not favor oppressive taxation by the government. In commenting on the trade conditions he doubted that there would be any long continuance of even the present abnormal prices for iron and steel. Looking to natural remedies for the trust evil, the establishment of a common interest between workman and capitalist was considered in the field of possibilities, but Mr. Farquhar's advice was that in the event of undertaking legislation against the combinations it should be directed at the two vital points—monopoly and secrecy.

Secretary Evans announced the receipt of several letters from other associations encouraging the Philadelphia organization in its work.

The report of the executive committee was presented. It referred to the success of the Pittsburg convention, which was attended by 350 foundrymen, 150 supply men and others, and 50 ladies. The interest is growing and each year the convention is being looked forward to as an important event. The committee noted that the foundry industry has never been so prosperous since the formation of the various foundrymen's associations. "It is our thought that the foundry conventions throughout the country have at least brought about a better feeling among the foundrymen; and while they have not to any extent made prices for castings or for labor, they have helped those who do not know how to get at the cost of castings, which has had a certain influence in maintaining prices."

The usual summer recess was voted, the association adjourning to meet the first Wednesday evening in September.

Important Deals Pending.

An erroneous report has been circulated to the effect that the deal is off for the consolidation of the sheet mills. The work has been almost completed, but Mr. Moore has gone on a two months' vacation, necessitated by his hard work for a year past, and the conclusion of the operation is necessarily deferred until his return to work.

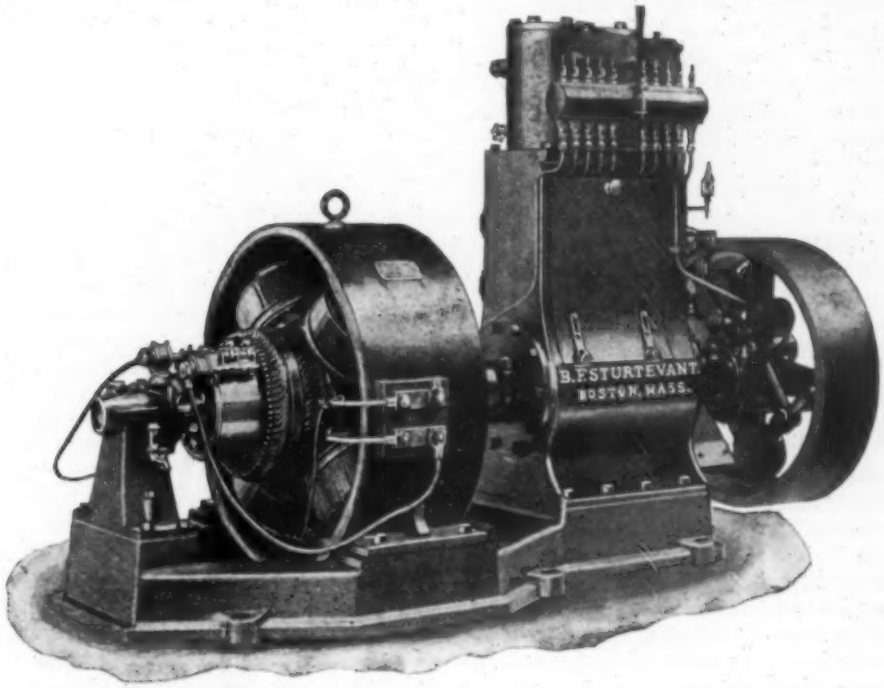
Officials of the Carnegie Steel Co., Ltd., deny the story which emanated from Chicago that the reorganization scheme had been dropped and that the Moores had declined to take further interest in the matter. W. H. Moore is taking a much needed rest. Mr. Phipps is in Europe and Mr. Frick sailed last week. The reorganization is expected to be completed, it is stated, early in the fall.

STURTEVANT GENERATING SET WITH DOUBLE UPRIGHT ENGINE.

When the ship Bay State was equipped by the Massachusetts Volunteer Aid Association, for her praiseworthy efforts in connection with our late war, the type of generating set illustrated herewith was introduced for lighting purposes. This engine is of a type particularly adapted to such work, being double cylindered, with cranks set at an angle of 180 degrees, so as to balance the reciprocating parts, and to permit of high rating speed. A single piston valve regulates the steam supply of both cylinders, and materially simplifies the construction. The running gear is rendered perfectly accessible through the door in the front, and all oiling is done from a single tank provided with independent sight feed oilers and tubes to conduct the oil to the bearings.

The governor is of the inertia type, and arranged to regulate the steam admission between 0 and ¼ cut-off. Mounted on a common bed plate with the engine is the generator, the armature of which is carried upon a common shaft with the engine, the outer end of the shaft being supported by a pedestal provided with ring oiler.

The field ring is of cast steel provided with four poles, the series winding upon which is of flat copper ribbon, while the shunt winding is of wire. As the illustration shows, these windings are placed on the pole entirely independent of each other, so that they may be removed separately.



The armature is of the barrel wound type, with internal spiders which support the discs, and through which, in connection with spaces left in the winding, a thorough circulation of air is produced when the machine is in operation, thereby keeping it well ventilated and cool. The brushes are of carbon, the brush-holders being of the reaction type, and they are arranged for continuous operation without sparking, at all changes of load up to 25 per cent overload. The design is such as to keep the temperature rise inside of 90 degrees F., after 10 hours continuous run.

This set was designed, constructed and installed by the B. F. Sturtevant Co., of Boston, Mass. It is one of a series of sizes ranging from engines having each two cylinders 3½x2½ up to 8x5½, with a corresponding range of output in watts from 4,500 to 32,000, and of weight from 1,650 to 9,000 pounds.

THE endurance of a well designed and thoroughly constructed fan blower is evidenced by a recent statement of The William Kennedy & Sons, Ltd., Owen Sound, Can.: "We have two Sturtevant pressure blowers in use, one of which has run over 32 years steady, and often 24 hours per day, and is apparently as good as when installed, although no one has as yet seen the inside of it. The other has been used for foundry purposes, and has been in use for about 30 years or so."

GERMAN PIG IRON CONSUMPTION IN 1898.

BY JACOB MUENCH.

On account of the present scarcity of pig iron and coke in Continental Europe it may be of some interest to know the pig iron consumption in the German Customs Union in 1898. The Bureau of Statistics of the Association of German Iron and Steel Manufacturers gives the following statement:

The production increased from 6,881,446 tons of pig iron in 1897 to 7,232,988 tons in 1898, an increase of 351,542 tons. To get correct figures of the imports and exports besides pig iron and scrap, the statistical returns add also the finished products to this statement, but with an increase of 33⅓ per cent in their weight to reduce the quantity of the products, (structural iron, and steel, hardware, machines, etc. etc.), to their pig iron equivalent. In this way the import list shows a decrease from 691,238 tons in 1897, to 672,030 tons in 1898. With this quantity the imports and domestic production of pig iron together increased from 7,572,704 tons in 1897 to 7,905,018 tons in 1898.

The export of pig iron and finished goods, (the above mentioned addition of 33⅓ per cent included in the latter), shows an increase from 2,037,322 tons in 1897 to 2,325,725 tons in 1898. There results therefore an increase in the home consumption from 5,535,382 ton in 1897 to 5,579,392 tons in 1898. While the production of the German blast furnaces increased 351,522 tons, or 5.1 per cent, the home consumption increased only 43,911 tons, or 0.8 per cent.

It is remarkable that the production of the German blast furnaces in 1895 for the first time showed a heavy increase—from 4,990,000 tons (in 1894) to 5,470,000 tons; then to 6,570,000 ton in 1896, to 6,880,000 tons in 1897, and 7,230,000 tons in 1898. This will be increased, by the present rate of production, to 8,500,000 tons in 1899. The home consumption was only 3,740,000 tons in 1895, 4,730,000 tons in 1896, 5,540,000 tons in 1897, and 5,580,000 tons in 1898.

The production of bituminous and hard coal in the Rhenish-Westphalian district was as follows: In 1895, 35,347,730 tons; in 1896, 38,916,112 tons; in 1897, 42,195,352 tons; and in 1898, 44,865,535 tons. Of the last named amount 58 per cent was coking coal, 29 per cent gas coal, and 13 per cent hard coal. The coal mines are sold ahead to March 31, 1900, and it is said there is a shortage of almost 1,000,000 tons of coke, which the blast furnaces buy in England.

The blast furnaces and rolling mills are sold up to June 30, 1900, but the extensive new steel works in Rothe Erde, near Aix-la-Chapelle, and in Rombach in Lothringen, will get in operation in a few months. The ore mines are sold up to the end of 1900, and ore is very high in price.

A CHARTER has been issued at Harrisburg, Pa., to the Warwick Iron & Steel Co., Philadelphia, capital $1,500,000.

FILLETS AND ROUND CORNERS ON MODERN MACHINERY CASTINGS.*

BY JOHN M. RICHARDSON.

Take some machine tool casting, a lathe, or planer, for instance, made from 25 to 40 years ago, and compare it with one of the same class brought out at the present time by any up-to-date concern, and what is the first point of contrast noted? You will all answer "the design." Wherein is this difference of design? It is to a great extent in the large and smoothly-rounded curves and heavy fillets everywhere present in its outline. Broadly speaking, some of these old-style castings look as though a carpenter had nailed together some sort of a foundation, and then, visiting a planing mill, had procured a quantity of mouldings, and with them trimmed it very liberally wherever possible, and finally, by someflourish of the magician's wand this would-be pattern had been suddenly transformed into iron and set down in the machine shop adorned with bright red and green paint, or a combination of both, neither "a thing of beauty," nor "a joy forever." Sharp angles, fancy moldings, panels, etc., look very nice on doors, store counters, and a great many kinds of furniture, but are decidedly out of place and likewise impracticable for cast iron.

I consider it of great importance to have a machine casting designed so that its exterior will present as smooth a surface as possible, and all angles and recesses of any kind provided with good liberal fillets. The advantage of this does not lie along any one line, but every one of the four mechanical arts, namely, draughting, pattern making, molding and machine work, which are so closely joined and interlocked as to be but four links of a giant chain, of untold strength and value to mankind, are each and every one benefited thereby. A drawing, where this matter has received attention, presents a much more finished appearance, and reflects credit on the designer, for it shows that he looked ahead as far as the foundry, realizing that the design and its resultant casting bear a close relationhisp to one another. Many a condemned casting is such not through any fault of the molder, but rather from bad proportioning of the metal, sharp angles, no fillets, etc., directly traceable to the drafting room.

Value of the Fillet in Patterns.

In the pattern department fillets serve a very important purpose, and now I am treading on familiar ground, and therefore can, without hesitation, give a short outline of their merits and demerits.

A fillet is actually a pattern strengthener, aside from its foundry value, provided it is composed of a substance having some tenacity in itself, and aside from this property, it is very often a time-saver also, for in fitting hubs, bosses and ribs, over curved surfaces, or, in fact, any part fitting another, where the intersection does not lie in a plane, much time and labor is required to produce a close fit, but a firm bearing can be quite easily arrived at, having, perhaps, rather open joints here and there, and here the fillet aids the pattern-maker by effectually hiding the imperfection. The molder who keeps his eyes open will notice quite a variety of materials worked into fillets on the various patterns he handles, especially if he works in a jobbing foundry. Wood, leather, lead, beeswax and putty comprise the kinds ordinarily used, and they each have their time and place, except the metallic one. A pattern being of wood has a fibrous nature, which will hold glue or any other adhesive substance, while lead has no affinity whatever for glue; so the only thing that can be employed is shellac or nails. I have used yards and yards of lead fillets, so can speak from experience, and I have seen old engine beds and their foundation boxes returned for repairs, where these fillets were fairly stripped away from the pattern; even the small bung-head wire nails used would not keep them anchored down.

Probably the finest fillet of all is made of wood, worked out of the solid pattern, having no feather edges whatever, but this is a very expensive kind, and can only be used on the finest jobs, so in every-day practice we have to add the fillet to the pattern as a separate part. For fillets from 1-inch radius down to ¼-inch, leather is unquestionably the best and most practical material that can be used, and when properly applied will not peel up even with the hardest usage, and requires no nailing whatever, glue being the only agent employed. Those who condemn the leather fillet for patterns probably do not understand the proper method of applying it. There is a sort of trick about it, to be sure, the keynote of success being hot water. Cover the back of fillet with thick glue, and place it quickly on the pattern, instantly drawing a round ended slicking tool of proper radius along its surface, bearing down hard to exude any superfluous glue, and following this with a woolen cloth wet in very hot water, to remove all pressed out by the slicker. Repeat this until not a particle of glue squeezes by the edge of the fillet, then wipe with a dry cloth. This is really not so much of an operation as it may seem from the description and many feet of these fillets can be applied in a very short space of time.

Where it is hard to bind the leather neatly around small curves, etc., just immerse it in hot water, taking it out instantly. This renders it perfectly pliable, but it means quick work, for the thin edges will shrivel and harden at once if not immediately placed in position and burnished down as previously described. A leather fillet put on properly, with strong glue, can only be removed when dry by main force, and will then come off with fibres of the wood adhering to it, and sometimes the leather itself will keep breaking,—it takes so much force to make it let go. Light patterns are strengthened by them to such an extent that nails are frequently unnecessary. Beeswax is all right for very small fillets, and for finishing out where leather ones come together at the top edge of a rib, when the curve is very small, and for many other places. The wax is prepared by being put in a cylinder, having holes of varying diameter in one end. This is warmed and the wax forced through with a plunger, and then applied with a warm slicking tool of the right radius. If used too cold the fillet will not adhere firmly to the wood. In fact, it is hard to lay wax fillets satisfactorily in a cold room, for both pattern and wax are chilled to commence with, and the heated iron bearing on the top surface of the fillet only makes it difficult to communicate the heat evenly enough through the whole mass to secure a firm contact with the wood, and after the pattern has seen constant use in the foundry, the wax will peel up badly; also it is not a durable subtance for a fillet if sunshine or heat of any kind strikes it to any extent.

Putty has always been used in great quantities in pattern making, and probably always will be, on account of its cheapness. Undoubtedly more feet of fillet can be applied in a given time with this substance, for a given amount, taking both the material and labor into consideration, than with anything else; but it is only adapted to cheap work, and not for standard patterns, as it is soft, easily dented, marred or bruised, besides imparting no element of strength whatever to the work. In some places plaster of paris is added to it, to increase its durability, but when this is done, it must be used immediately after mixing. Black putty is also frequently used. This is nothing but common putty mixed with lampblack, and is employed only on cheap work, having but one coat of shellac, this being applied after the sand papering, thus comparing in color with the blacking on the pattern, and saving a second coat.

When fillets are called for having a radius above 1-inch, then they must be worked out of wood, and this should be done after gluing to the pattern, not before, in order to have the feather edge adhere as firmly to the work as possible. It is almost impossible not to have the edge curl away if cut out first, and then fastened to the pattern, even if the precaution is taken to have the angle of the fillet made slightly greater than that of the corner it fits, in order to cause a binding of the edges.

Advantages in the Finished Casting.

A mold of any considerable size can be made more safely, quickly and easily and with a minimum of labor, where these points have been considered in the design, and carefully followed out in the pattern, and with far more chances for a perfect casting, as the danger of cracks in shrinking have been eliminated. How many castings are spoiled by having some slender part joined to a heavier one, with no fillet where they come together, thus causing a crack by the shrinkage

* Read at the Pittsburg meeting (May, 1899) of the American Foundrymen's Association.

strain at the junction, it would be hard to determine.

A pattern where heavily rounded wherever possible will certainly leave the sand very much easier and with less danger of breaking the mould, thus saving labor in patching and mending, which is always a form of dead loss to the proprietor on day work, or to the molder on job work, besides being a great vexation to the workman himself

I would go so far to say that every edge of a pattern, except on surfaces to be machined later, should be rounded, even if the radius of curvature is so small on some light work, that it can be done entirely with sand paper and on brackets, ribs, heading, etc., it is much more satisfactory when one gets accustomed to it to have the edges terminate in a semi-circular section, rather than flat with the two corners somewhat rounded.

This rounding of outside surfaces is necessarily on the pattern itself, but there is something else frequently not on the pattern that is expected just as much to be on the casting, and that is, the fillets. How many molders can testify to getting patterns with a chalk mark all around every corner and rib, and this injunction in two words, "cut fillets," also marked in chalk somewhere on the surface. Once in a great while a case occurs where this is justifiable, but it should be rare. A molder does not profess to be a sculptor and when he is forced to carve out fillets in the sand, who can blame him if, instead of being the radius of a circle they prove to be the hypothenuse of a right angled triangle. Then, too, there are often places in the mold where it is very difficult to do this, without dropping sand down into parts where it is hard work to remove it, and the result will be an imperfect casting.

Fillets in Core Work.

Another thing I wish to mention in this connection, although it does not show on the casting except by a fin which must be clipped off before leaving the foundry, is still in the nature of a fillet. When a core is placed in position horizontally, and the cope closed down, the impression made by the core print where it joins the main pattern is liable to be crushed where it enters the body of the mold, unless the molder shaves off the corner so that, at this juncture, the core does not quite touch the edge. This shaving process is done as a foundry precaution, and varies from a slight amount on small work to perhaps ⅛-inch or more clearance all around where the core enters the mold, this gradually tapering off to the size made by the core print.

The fact of cores coming in the interior of a casting, and the places made by them being entirely out of sight, is a sort of "will o' the wisp" to some, who imagine that fillets are unnecessary because they do not show. This is a great error. They are just as much needed here as elsewhere, to strengthen the casting, and to help resist shrinkage strains, and should be put in of a size proportioned to the casting to which they belong, but need not be made excessively large, as they frequently are on the outside of a pattern, simply for the graceful effect, for these are not seen. There place is in the core box, and not as a production of the c remakers trowel or file. It will sometimes happen that a fil et is called for, on what is the top, or open end of a core box, thus making it impracticable for the patternmaker to provide for it. In such cases the coremaker ought not to object to making it in the sand, and, as it comes within the casting, and is out of sight, a plain flat damper is all that is required, and the fillets already in the core box will be a guide for the size. Another case showing the utility of heavily rounded outlines and fillets on castings is when they undergo the cleaning process, and they will also pickle and peel more freely, as there are no sharp corners for the sand to stick into, and thus time, and the edges of cold chisels, are saved.

As we reach the machine shop, the man who snags the casting finds no sharp corners full of sand to be scraped out with old files, and as he scours his work down with the coarse emery brick preparatory to painting, he can do much more effective service, for as the stone becomes rounded on the corners with use, it will still clean the large fillets, whereas with sharp corners it could not, and finally, when the iron filler is applied to one of these smoothly outlined castings, it can be sand papered down easily and quickly, so that, after the painting is completed, the effect, when properly done, is almost like velvet.

A PACIFIC SITUS FOR IRON-MAKING.

BY W. C. CRONEMEYER.

In February of this year the writer made a trip to the State of Washington to get the benefit of the splendid climate which he had been informed was to be found in the region along Puget Sound, with the desire of regaining his health, which had been much impaired. After spending about two weeks in this part of the country, in the State of Washington and on Vancouver Island, it became evident that he was really gaining health to a very satisfactory extent. Becoming imbued with the enthusiasm which the people of British Columbia and Washington feel for their region, the writer naturally made some investigations as to the prospects which that part of the country offered for the future development of the metal industries, especially of iron and steel manufacture, and the results of these investigations are now presented for the benefit of those whom the matter may interest.

Geography of the Far Northwest.

The northwest corner of the State of Washington is indented by an arm of the Pacific ocean, and from this great arm there are many smaller arms extending into the land, making a great number of natural harbors. On the other side of this large arm is the island of Vancouver, which is a part of British territory, and lies practically parallel with the main land of British Columbia. The boundary between the State of Washington and the mainland of British Columbia is the forty-ninth parallel of latitude, but the island of Vancouver extends some distance south of this parallel. Between Vancouver island and the American territory is the strait of Juan de Fuca, extending east and west, and between the island and the mainland of British Columbia are the Strait of Georgia and north of it Queen Charlotte Sound. From the eastern end of the Strait of Juan de Fuca extends south a system of "inlets" to a point below the middle of the State in a north and south direction, but no large rivers flow into them, on account of the high mountain range extending north and south, to the east of which is the Columbia River, flowing first south and then bending around to the west and breaking through the mountains in an east and west direction, and forming the southern boundary of the State. On the inlets which have been referred to are a number of cities which have grown very rapidly in the last few years: Olympia, Tacoma, and Seattle. Further north than these a number of cities have been laid out by enterprising real estate parties on the American side, while in British Columbia, especially in Victoria, which is at the southern end of Vancouver Island, influential people were hard at work at the time of the writer's visit in the effort to induce English capital to come to that island and invest in iron and steel industries. The provincial government of British Columbia passed a law which provides for a bonus of $2 for every ton of pig iron and $4 for every ton of finished product in the iron and steel line that may be manufactured in that country.

Iron Making Possibilities on the Canadian Side.

British Columbia undoubtedly possesses the necessary raw material for the manufacture of pig iron. At Nanaimo, on the eastern coast of Vancouver Island, and just north of the forty-ninth parallel, on the straits of Georgia, are large coal fields which are opened up and produce bituminous coal well suited for coking. There is a railroad, some 60 miles long, extending south from Nanaimo to Victoria, on the southern end of the island. Other large coal deposits are found in several places on the island. Iron ore of very rich quality has been found on the islands in Barclay Sound, on Texada, and Redonda Islands, in the straits of Georgia, and at Rivers Inlet on the coast of the mainland north of Vancouver Island. These deposits are all near tidewater and accessible, while there are other deposits in various parts of Vancouver Island. The writer personally visited the mine already opened on Tzartoos Island. This island is in Barclay Sound, on the west, or rather southwest coast of Vancouver Island, about 75 miles in a straight line from Victoria, which is at the southeast end of the island. There is a peak on Tzartoos Island, whose top is about 1,000 feet above the sea level, and from its top down about 150 feet it seems to be a mound of solid iron ore. At a lower point, where the mound is about a mile in circumference, an entry has been driven into the hill from

one side about 50 feet toward the center, the entry being about 10 feet wide. From this entry the writer secured a number of specimens of the ore, which is granular and magnetic, having thin veins of limestone running through it. The base of the mountain is about 600 feet from deep water, and a wharf could be built there suitable for landing large ocean steamers as well as scows, into which the ore could be dumped by means of a chute. Experienced mining engineers estimate that this deposit contains about 5,000,000 tons of ore. Several analyses of this ore have been made, six of which are here appended. No. 1 is by Mr. Dewsnap, mining engineer and chemist at Seattle; No. 2 is by the government office at Vancouver; No. 3 is by the Cleveland Steel Works, Middlesborough, England; No. 4 is by Dr. Otto Wuth, of Pittsburg; and Nos. 5 and 6 are by Mr. G. M. Godspeed, chemist of the National Tube Works, at McKeesport, Pa.:

	1	2	3	4	5	6
Iron	64.00	64.01	66.60	66.62	67.98	69.160
Silica	7.35		2.00		2.67	1.200
Alumina	0.52			0.14		
Sulphur	0.0054	0.008	0.02	0.006	trace	trace
Phosphorus	0.0071	0.01	0.01	0.003	0.008	0.007
Lime	3.76		4.00		3.000	0.250
Manganese	trace				0.250	0.169
Magnesia					1.250	0.120

An analyses of the ore at Rivers Inlet, on the mainland north of the extreme end of Vancouver Island, made by Gilchrist and Riley, London, Eng., is as follows:

Iron,	69.85
Manganese,	trace
Silicious matter,	2.75
Sulphur,	0.06
Phosphoric acid,	trace
Moisture,	trace

The United States import duty on iron ore is 40 cents per ton, but as the freight charges for shipment by water are light, the ores from Vancouver could be delivered at a reasonable cost to any point along the American side of the strait of Juan de Fuca or Puget Sound. All these deposits near tidewater in Vancouver Island that have been mentioned are above sea level and while some would require stripping, nearly all appear at the surface and could be worked by means of the steam shovel, which would unload the ore into a chute from which it would be conveyed by boats or scows on the salt water. In Barclay Sound the water is still, permitting the ready loading of scows, and the distance from here, in the open sea, to Juan de Fuca Strait, is short, so that periods of still water could be found in which to bring the scows over and unload them at any of the numerous harbors in Juan de Fuca Strait or at other points to which tidewater extends. The price named by the owners of the Barclay Sound mine at which the ore could be delivered on the American side, duty paid, was $1.55 a ton.

In the Cascade mountains, on the American side, large deposit of iron ore have been found; near Cle-Elum, where the bed is said to be over five miles long, and other large deposits of high grade ores are found at Skyhomish, near the Great Northern Railroad, and other deposits near the Seattle International Railroad. These deposits are within five to 15 miles of the respective railroads, and branch roads would have to be built from the main road to reach them. On Lopez island is a large deposit of ore said to contain about 50 per cent of iron.

The coal business in Vancouver Island has already reached very large dimensions, and the coal has been found suitable for coking purposes. Large quantities of coke are manufactured at Nanaimo and the product is shipped mainly to the Kootenay mining regions where it is used for smelting purposes. This region is in the southeastern part of British Columbia and the principal product is copper, gold also being found. Rossland is the headquarters.

Coal Measures of Washington.

The State of Washington also contains immense deposits of coal in various parts of the state and the coal is of different quality. Bituminous, lignite and anthracite coal is found. Good lignite coal for steam making purposes is mined on Lake Whatcom, which is very near Fairhaven, near the northwestern corner of the state. An excellent grade of bituminous coal is mined at Cokedale, also near Fairhaven, by the Fairhaven Land Co., which company also manufactures a coke which is said to be equal in quality to the best Connellsville coke. This coke is furnished to the foundries all along the Pacific coast. The mines and coke ovens are connected by rail with tidewater and are producing a very large tonnage. The coal mines in the State of Washington differ from those in Western Pennsylvania in that they have to be driven vertically. The country there being of volcanic nature it seems as if an upheaval put all the coal deposits on their ends, and while in Pennsylvania the beds lie horizontal, or at least nearly so in the State of Washington the seams are vertical, or somewhat inclined from the vertical. The method of mining usually employed is therefore to drive a horizontal entry into the hillside until the vein is struck, when a vertical shaft is sunk downward in the vein and then openings are driven to one side and the other from this shaft at various levels. The coal mining business of the state is already a leading industry, almost the entire central portions of Whatcom and Skagit counties, the two northwestern most of the state, being underlaid with workable veins of coal. A number of mines have already been opened and are shipping large quantities of coal to the various coast cities. Almost the entire output of the Fairhaven Coal Co.'s mines in Skagit county is used in the manufacture of coke, which finds ready sale in supplying the smelters of Puget Sound and British Columbia. The Blue Canon mines on Lake Whatcom ship large quantities of coal from New Whatcom to the coaling station all along the coast, to be used by steamships.

The different veins of coal run respectively 3, 4, 5, 6 and 8 feet thick. The 8-foot vein widens out at places to 20 feet thick. The following are analyses of the different kinds of coal that are found in the State of Washington, compared with Cumberland Valley coal:

	Carbon	Volatile
Skagit River	86.15	13.85
Visqually	74.28	25.72
Wilkeson	71.10	28.90
Camonado	65.52	34.52
Franklin	59.61	40.37
Cumberland Valley, Md.	83.57	16.43

Another analysis of the Skagit river coal is as follows:

Fixed Carbon	76.96
Volatile	12.37
Ash	10.29
Moisture	0.48

Manganese is known to exist on Puget Sound, but the deposits have not been developed. There is, however, a good supply in the bay of San Francisco, from which abundant supplies could be drawn. Limestone is found on nearly all the islands in Puget Sound, but especially on San Juan Island, where the best limestone in the world is said to exist.

Other facilities which this northwestern country offers for industrial purposes ought to be mentioned. In the mountains and hills near the coast there are numerous large fresh water lakes, which are situated from 400 to 500 feet above tidewater, and only from one to five miles from the coast, so that the water could be led in pipe lines to any point along the coast. The pressure of the water in these pipes would be such that by employing turbines all the electric current required for industrial establishments could be produced, and the power could be used also for other purposes. Entering the Straits of Juan de Fuca there is the Ellwa river, in which there is very large and powerful falls, which could be utilized in the production of the electric current, to be used for railroad purposes and conveying materials from one point to another along the strait, just as the power from the Niagara Falls is used in running traction cars along the shores of Lake Erie.

Local Consumption of Iron and Steel.

The consumption of pig metal for foundry purposes along the Pacific coast is estimated at about 100,000 tons a year; they draw their supplies of late mainly from Alabama by rail, or by water from San Francisco. The price paid for Southern No. 2 foundry pig was $22.50 when the same grade of iron was selling at Pittsburg for $10 a ton. The writer's own crude calculations would indicate that with the facilities at command pig iron could easily be produced locally for $15 a ton, considering the fact that coal is bringing a very high price there, i. e., from $2 to $2.50 a ton, but it is stated that if Pennsylvania methods could be applied to coal mining in that district the coal and coke would not necessarily cost very much more than what it now costs in Pennsylvania.

The demand for castings in shipbuilding on the Pacific

coast is very large. Most of these castings are now drawn in a finished or partly finished state from the eastern part of the country, or they are even imported. If the cost of pig metal were reduced no doubt an immense iron industry, in cast iron and wrought iron as well, could be built up in that part of the country.

There is a wire rod and wire mill at Everett, the point at which the Great Northern reaches Puget Sound, which has been bought by the American Steel & Wire Co. The con.ern did considerable business, but had to buy the billets in the east, but even with that the trade seemed to very profitable. There are two blast furnaces in the region, one in Oregon and one in Washington. Both are inactive. The one at Port Townsend, Washington, is owned by the Union Iron Works, and the writer was told that some of the iron used in the Oregon was made at this furnace. The one at Oswego, Oregon, is owned by a company which operates a cast iron pipe foundry, which is in operation. Both of these blast furnaces were built to make charcoal pig iron, but have been idle for a number of years. There is nothing in that part of the country but soft wood, and with the charcoal made from this soft wood it requires an immense quantity to the ton of pig iron, so that with the introduction of the modern blast furnaces the charcoal furnaces could not run successfully, nor could they in all cases make the quality of iron that was required.

There is very good land for manufacturing purposes along the south side of Juan de Fuca Strait, as well as on Vancouver Island opposite. At Port Crescent, on the south side of the strait, where there is a very good harbor, there is a great deal of available land. At port Angeles, a few miles to the east, there is not much available land left On the mainland, just south of the Canadian boundary, there is very good land for manufacturing purposes. Fairhaven andWhatcom are towns on Bellingham Bay in this locality, and just south of these towns is Chuckanut Bay, a part of Bellingham Bay, and bordering it is some very good land. Near here are two large lakes elevated about 400 feet above tidewater, from which a pipe line could be run and power secured as well as good water. In the western peninsula, which is bordered on the north by the Strait of Juan de Fuca, the same conditions exist, the Olympic mountains, only a short distance south from the coast, having a number of fresh water lakes at a considerable elevation. There have been booms at a number of the towns in this region, where the growth was unhealthy and has naturally been followed by a sharp reaction. At the height of the boom at Port Crescent lots 40x120 feet were sold at from $1,200 to $1,500, but the boom collapsed in 1889, and one company now owns the whole property.

Mineral Production of the Region.

The following table is appended in order to show what has already been accomplished in this region. The table shows the quantity and value of the mineral production of British Columbia in the year 1896 and 1897:

	Customary measures	1896 Quantity	1896 Value	1897 Quantity	1897 Value
Gold (placer)	Ounces	27,201	$ 544,026	25,676	$ 513,520
Gold (lode)	"	62,259	1,244,180	106,141	2,122,820
Silver	"	3,135,343	2,100,689	5,472,971	3,272,836
Copper	Pounds	3,818 556	190,926	5,325,180	266,258
Lead	"	24,199 977	721 384	38,541,135	1,390,517
Coal	tons 2,240 lbs.	894,882	2,688,666	882,854	2,648,562
Coke	"	615	3,075	17,832	89,15
Other Materials			13,000		151,60

All of the coke included in the table above came from the coke ovens at Comox, Vancouver Island, the bulk being shipped to the Kootenay smelters, and about 2,600 tons being shipped to California. A new market for this coke is now opening up in Mexico, where several shiploads have already been shipped to one of the large smelting works situated not far from the coast.

The coal production of the State of Washington was 1,195,504 short tons in 1896, increasing to 1,434,112 tons in 1897. The production in 1897 was the largest in the history of the state, although in three years, 1888, 1890, and 1893 the value of the product was greater than in 1897. The production of Skagit and Whatcom counties, which constitute the northwestern district, was 27,010 short tons in 1896 and 20,325 tons in 1897. The balance of the state's coal production is farther south and centers mainly around Seattle.

In 1897 there were three establishments in Washington producing coke, and having 120 ovens built. The coal used was all washed run of mine, but from 1891 to 1895 most of the coal used was washed slack. The production in 1897 was 26,189 short tons against 25,949 tons in in 1896. In 1897 Skagit and Whatcom counties produced a trifle over one-third of the total, and in 1896 considerably more than one-third of the coke made in the state. Washington contains the only coking plants on the Pacific coast. In 1896 and 1897 the yield of coal in coke was 67 per cent. This is the highest average shown by any state as far back as the Geological Survey figures go. In 1897 the yield of the Connellsville region was 67 per cent, in 1896, 67.4, and in 1895, 67.2, but the other districts pull down Pennsylvania's average.

Electric Power and American Shop Excellence.

Nothing within the past year or two has directed more attention the world over to the capacity for rapid and good work in American engineering establishments than the recent award of the contract for a bridge over the Atbara River, a tributary to the Nile, in the Soudan, to an American firm of bridge builders. The bridge was needed most urgently for railroad use in connection with Sir Herbert Kitchener's famous military operations; indeed, time was of the first importance, and in this respect the American builders distanced all other bidders, guaranteeing to deliver the whole bridge of seven spans in seven weeks, while the earliest delivery that could be obtained from any of the British firms was for two of the spans in six months. Why American builders should, in this instance, have led the world and have crowded British firms out of a territory which they might well have considered peculiarly their own, is an interesting question. Improvements in methods, the introduction of time and labor-saving devices, with the incidental reduction of costs, furnish a ready answer, and it is particularly interesting to note that as not the least of these improvements electrical conveniences have been cited. Electrically-driven shop tools, heavy ones as well as light ones, have eliminated many difficulties of operation, and electric cranes have greatly simplified the handling of heavy pieces. The principle of portability in the tools, moreover, has been applied to the widest possible extent, and, in itself, has contributed almost as much as any one other thing to that rapidity and excellence of output for which American shops have become noted.—[Cassier's Magazine for June.

THE Pottstown Iron Co., Pottstown, Pa., will be reorganized under a plan to which all the creditors have assented. The works consist of a blast furnace, plate mill, nail works, and basic Bessemer steel plant, with three 10-ton converters, besides a large puddling and universal mill. The latter departments are now being operated under a lease by the Glasgow Iron Co., and will not be disturbed. The steel works and furnace, idle for five years, will be put in operation as soon as the reorganization has been effected. The new plan provides for the adjustment of $2,242,000 of indebtedness. The holders of $1,000,000 general mortgage bonds received first preferred stock. After this comes second preferred stock to the holders of $450,000 consolidated mortgage bonds, and after this comes common stock. There will be four, two and one directors respectively for the three classes of stock.

IT is believed negotiations for the proposed $50,000,000 consolidation of plow manufacturers have been practically abandoned and that the deal will be formally declared off for the present. Some of the manufacturers have not at any time given options on their plants.

AT New Castle-on-Tyne, Eng., three of the largest shops connected with the Armstrong-Whitworth ordnance works were destroyed by fire June 11. The damage is estimated at close to $1,000,000.

THE navy department has decided to purchase a small amount of Harveyized armor plate at $400 per ton, needed for the four monitors authorized by Congress, and for the diagonal plates of the battleships Maine, Missouri and Ohio.

THE Anchor Fence Co., of St. Joseph, Mo., has bought the plant and business of the Anchor Fence Co., of Kansas City, Mo., and will remove it to St. Joseph.

METHODS FOR THE IRON LABORATORY—I.

BY FRANK L. CROBAUGH, CLEVELAND.

[In this and three or four other articles of the series the writer outlines for the benefit of beginners in foundry, steel works and blast furnace laboratories the methods he considers preferable.—Ed.]

Sampling.

A true representation of material can only be had by cautious sampling. Iron ore, limestone and coke depend for their value upon certain elements contained. Ascertaining these values by sampling and analyses is a chemist's work.

The greater part of the iron ore consumed in the United States is shipped from the Lake Superior region in boats. Two very good opportunities are presented for sampling the cargoes; fiirst, when the boat is loading; second, when the cargo is being discharged. The latter time is conceded the better. The usual method of unloading a boat is to make openings in the ore under all or a part of its hatches. When about one-third of the ore has been removed, and the bottom of the boat is exposed, is considered the most suitable time to begin sampling. There are presented at this time new surfaces varying in depth with the capacity of the boat By a study of these surfaces one can form a good opinion of the proportion of lump and fine ore which the cargo contains. He can further note the different characters of lump and fine ore. The essentials in taking a sample, after placing such judgment upon the contents of a hatch, are: first, to take the lump and fine ore in a correct proportion, and second, to take the various kinds of lump and fine ore in such proportions as they actually exist.

Since boats often carry grain cargoes alternately with ore, the sampler must be on the alert to avoid kernels of grain in the ore. The habit on many boats is to sweep the refuse from deck and table into the hold. Such refuse must also be avoided. It is a disputed question whether a cargo of ore containing a few pieces of foreign material should have included in its sample any portion of such material.

The sale of ore, until recently, was based upon its analysis after being dried at 212 degrees Fahr. Until within six years a moisture determination was not frequently required. Of late a careful estimation of moisture is required in the sample from each cargo, and the sale is now based, especially in wet ores, upon the percentage of iron in the natural state, figured from the analysis of the ore dried at 212 degrees Fahr., and the percentage of moisture.

Not less than 100 pounds of ore should be taken from the surfaces, proportionately at the several hatches; at least every three square feet of newly exposed surface being represented. Lump ore is then broken finer and the mass intimately mixed, and 30 pounds sampled from the mixture, all or a part of it being protected from loss of moisture by enclosure in a tin can. Much care must be taken to avoid dissipation of moisture in the sample. The ore must not be sampled in bags unless they be previously moistened. In mixing the ore do so rapidly, avoiding exposure to the sun. When a sample arrives at the laboratory it should be weighed at once for moisture.

A convenient method for making the determination for moisture is to use a counter poised pan. Distribute the ore evenly in the pan, take its weight. Drying will require from two to six hours. The loss in weight is moisture. In the original sample no lumps should be taken of greater weight than 20 grammes. Such pieces as are taken from the larger lumps should have at least one half new surface and should frequently come from the interior of the larger lumps. In breaking lumps for the sample, care should be taken not to break them at all times in the planes of easy cleavage but as frequently at an angle with such plane.

The principles employed in sampling a cargo of ore may be applied when sampling in the mine, on stockpiles, and cars, where the opportunity for judging the kind, character and amount of fine ore is not so good. Remember that in a stock pile much lump will roll to the outskirts of the pile, and that shipment in cars will tend to bring all lump to the surface. The foregoing principles may be used in sampling limestone and coke. At upper lake ports the ore is sampled at intervals during the loading.

Preparation of Samples.

The methods of sampling iron and steel depend so much upon circumstances and are so peculiar to the methods in which these materials are produced, that in space available it will be impossible to describe what portions of the metal should be drilled to obtain an average of the whole. A knowledge of where certain elements segregate in metal, and how, for example, silicon and sulphur distribute themselves in iron on the casting house floor must be involved. For iron ore, limestone and coke crushers run by power are serviceable, but the work may be nicely executed by aid of a chrome steel mortar and rubbing plate. This metal is very hard and strong, yielding no elements to even the hardest iron ore. I prefer to proceed as follows:

Crush the entire sample in the mortar until it will pass a four mesh sieve. Commingle the crushed mass very intimately on oil cloth, by gently rolling it over and over, which may be done by lifting successively alternate corners of the cloth. Spread the ore evenly on the cloth by aid of a trowel, fill a quart cup from the mixture by sampling it systematically. Take special care to dip the trowel entirely through the mass each time. This quart of ore is then crushed in the mortar until it will pass an eight mesh sieve. Mix as before, sampling this time a pint from the mixture, which throw portion wise upon the rubbing plate, where grind it to pass a 40-mesh sieve. The mass is again mixed and 100 grammes sampled from it. Rub this portion upon the plate until fine enough for analysis, when it will usually pass a 100-mesh sieve. Mix this portion intimately and dry at 212 degrees Fahr. (for most material). When cold it will be ready for analysis and is of sufficient quantity to leave a reserve powder.

Iron.

Since the percentage of this element regulates the selling price of ore more largely than any element save phosphorus, a correct estimation of it is indispensable. There are only two methods for the determination of iron which have won universal favor among chemists. One depends upon the titration of ferrous iron with a standard solution of potassium bichromate, the end reaction being ascertained by aid of a solution of potassium ferri-cyanide used as an indicator.

The other method, and the one which I prefer after cautious comparison with the foregoing, depends upon titration of ferrous iron with a standard solution of potassium permanganate, which of itself acts as an indicator. To standardize either of these solutions it has become the usual practice to do so by aid of standard ores assigned, a definite percentage of iron, which is the average of closely concordant results. Since the determination of iron involves the titration of a complex mixture, I have usually found the iron value obtained by standardizing on ammonio ferrous sulphate slightly greater than the value obtained by use of standard ores. The commercially recognized standards, when used to establish the value of a permanganate solution, involve the conditions found in the actual determinations. If one desire to employ ammonio ferrous sulphate for this purpose, he must carry a correction factor. I do not recommend the latter course of proceedure. Many reducing agents have been suggested for use with either method. It is generally conceded that stannous chloride is the most rapid and easy of application. In preference to using a salt found on the market, I dissolve pure tin in hydrochloric acid, sp. gr. 1.20, leaving an excess of acid. It is well to make up a large quantity of this solution, keeping it in sealed bottles. It is necessary to ascertain approximately the reducing power of this solution. My solutions are usually of such strength that about 3 5-10 c. c. will reduce one-half gramme of the average ore. It has been found that if to ore plus the amount of hydrochloric acid necessary to dissolve it, there be added stannous chloride, that solution is very much more rapid and complete than without this addition. I have adopted this plan It often saves three-fourths of the time otherwise required to dissolve the ore. In dissolving an ore only so much stannous chloride solution should be added as will nearly reduce the iron. When the solution of the ore is complete, add to it, while yet hot, stannous chloride solution from a burette until completely reduced, leaving an excess not to exceed 1-10 c. c. of the stannous chloride solution. In case a larger amount has been

added, add permanganate solution until a tinge of ferric iron is produced. Destroy this as above In both volumetric methods the above conditions must be attained before further proceedure. In "Notes on Metallurgical Analysis," by Lord, page 15, the bichromate method is best described. When operating the bichromate method I prefer to use a mercuric chloride solution of strength described under the permanganate method. I also prefer to conduct all operations, including titration, in a beaker of capacity there described. I think it better to make duplicate weighings for this determination rather than take aloquet portions of the same weighing. I prefer the permanganate method as follows:

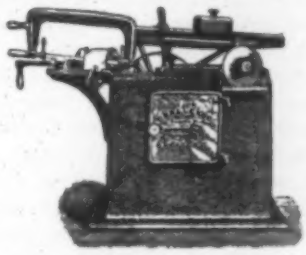
Weigh one-half gramme of ore into a beaker without lip, 2¾ inches top diameter by 4¼ inches altitude. Treat with 10 c. c. hydrochloric acid sp. gr. 1.10 plus stannous chloride. Effect solution by heat, avoiding vigorous boiling. Proceed while contents of the beaker is still very hot, to a condition of complete reduction with a limited excess of stannous chloride. The contents of the beaker must now be rendered cold, when add 50 c. c. of mercuric chloride solution (10 grammes per litre), stir vigorously, then add 10 c c. of titrating mixture, and stir vigorously again. Wash the contents of the beaker into a large white bowl, dilute to 400 c. c. with water. After thorough stirring, titrate at once with a standard solution of potassium permanganate.

The approach of the end reaction may be noted by a faint darkening of the solution The end reaction is a feeble pink. Titration should be rapid. The end reaction is of short duration and must be ascertained without delay. The titrating mixture is made by dissolving 160 grammes of manganous sulphate in water, dilute to 1,750 c. c. and adding 330 c. c. of 85 per cent phosphoric acid and 320 c. c. of sulphuric acid sp. gr. 1.84. The manganese sulphate is converted into manganese chloride, thus avoiding possible decomposition of the permanganate solution by hydrochloride acid. The phosphoric acid unites with the ferric iron produced, thereby rendering the titrated solution white and making more evident the end reaction. A beaker of the dimensions named is convenient because it enables one to submerge the ore in a minimum quantity of hydrochloride acid and because it is of sufficient height to condense any chloride of iron that may volatilize. I prefer to titrate in a white bowl because it renders the end reaction more easily detectable. Certain ores contain organic matter which if left unchanged in the solution to be titrated, might be acted upon by the standard permanganate solution. My habit is to dissolve such ores in a minimum quantity of hydrochloride acid sp. gr. 1.20; when solution is complete add at intervals several crystals of potassium chlorate. Evaporate until the chlorine is expelled, when a very small quantity of the acid remains. Proceed with the reduction. If this organic matter be not destroyed, it renders the slight excess of stannous chloride difficult to adjust because it imparts to the solution a color resembling ferric chloride. Results of the permanganate method agree with those of the bichromate method. Time required for a determination by the permanganate method will not exceed 30 minutes; by the bichromate method 35 minutes. An experienced operator can usually make 100 determinations per day, using the permanganate method. When standardizing a permanganate solution by use of ore, divide the percentage of iron which the ore contains by the number of c. c. which it titrated, the quotient will be the percentage value of one c. c. of the solution. Following are the results by several chemists:

Rattle, Nye & Hollis, Chicago,	64.57
" " " Cleveland,	64.30
Booth, Garrett & Blair Philadelphia,	64.54
A. S. McCreath, Harrisburg,	64.45
Cremer & Bicknell, Cleveland,	64.53
John Douglas, Sharpsville,	64.45
R. N. Dickman, Cleveland,	64.50
Crobaugh, Sharon,	64.41
E. P. Jennings, Hurley, Wis.,	64.30
L. W. McKeown, Youngstown	64.25
C. P. Hyde, Joliet, Ill.,	64.10
Carnegie—J. H. Bald, Edgar Thomson,	64.90
" —J. M. Camp, Duquesne,	65.04
" —Chas. Murray, Edgar Thomson,	64.15
Babbitt, Wellman Steel Co.,	64 61
W. W. McKeown, Cherry Valley Iron Co.,	64.26
H. B. Crowl, Duluth,	64.45
F. C. Steese, Brier Hill,	64.40
Average,	64.457
Lerch Bros., Eveleth, Minn.,	68.92
Illinois Steel Co., South Chicago, Ill.,	69 09
Cremer & Bicknell, Cleveland,	68 85
Benedict Crowell, Cleveland,	69 05
Frank L. Crobaugh, Cleveland,	68.82
F. A. Emmerton, Cleveland,	68.90
Oscar Textor, Cleveland,	68.85
W. J Rattle, Cleveland,	68.90
H. R. Payne (Emma Furnace), Cleveland,	68.88
Mr. McKeown, Cherry Valley Iron Works,	68.90
Henry Thomas, Bellaire, O.,	68.83
E. T. Griese, Duluth, Minn.,	68.85
Clarence Mott, Mt. Iron, Mich.,	68.89
R. B. Green, Two Harbors, Minn.,	68.86

CHALLENGE POWER HACK SAW.

The power hack saw manufactured by the Patterson Tool & Supply Co., of Dayton, O , is designed for the cutting of metals up to six inches in diameter. The carriage that carries the saw frame back and forth and the ways on the top of the main frame, are planed and gibbed, so that any wear may be taken up. The pitman with its ⅜ inch bearings and the 1-inch rocker shaft on which the saw frame swings have adjustable bearings. The crank shaft is 1¼ inch in diameter and has an additional support on bearing on its outer end back of the driving pulley. This gives rigidity to the shaft and adds to the life of the machine. The vise is all planed and the jaws swivel so that work can be cut at different angles. The vise can be set backward or forward, and the saw made to cut in



different places, so that if one end of the saw is worn out the other end can be used.

A feature of the Challenge saw is the improved friction which automatically prevents dragging of the saw on the return stroke. It is gently lifted from the work in coming back and is given a positive cut on the forward stroke, stopping automatically when the cut is finished. In connection with the friction there is a weight that can be shifted back and forth on the saw frame. This is used when cutting light rods, tubing, etc., or when working heavy stock, if required. The saw is made to cut straight by moving to the right or left the adjustable handles at the end of the saw blade. The machine is of the cabinet pattern and weighs 350 pounds. It has a 16-inch pulley, with a 3-inch face.

Interchangeable System in American Shops.

An important factor in America's industrial progress has been the extended application of standards. There are standard dimensions for materials; standard sizes, parts, and capacities of machines; standard gauges for close measurements; standard systems of inspection and testing, and others. These different forms or methods of standardization have usually originated or developed in commercial and manufacturing activities, independent of any governmental instigation or control. This principle of standards, as carried out in individual American shops and factories, has developed the well-known "interchangeable system" of construction, which, by forcing attention and care upon little things has further specialized operations, and has stimulated the development of special machines to perform these operations to the end that the cost of production has been greatly reduced. Such standardization inside and outside of the shops also aids rapidity of production, inasmuch as standard material can be kept in stock to form standard parts or to complete standard machines, apparatus, or goods, all before these are even ordered. These results,—cheap production and prompt delivery,—in connection with a high grade of product, to which these methods contribute, are most powerful factors for securing and maintaining foreign trade. Such influences are particularly active in America to-day.—[Cassier's Magazine for June.

TEST OF A STEAM SEPARATOR.*

BY. F. L. EMORY.

The test recorded below is that of a baffle-plate pattern separator designed to serve as a live steam seperator, as an exhaust steam separator or trap, and as an oil extractor. The method of testing the separator consisted, in brief, of a determination of the character or quality of the steam before entering the separator and also its quality after leaving it. Various pressures of steam and different velocities and amounts of steam running through the separator were noted, as also the quality of the entering steam was changed for various runs, as will appear from the readings and quality results of the wet steam calorimeter.

Apparatus used: In the first eleven runs noted in the tabulation the following method was pursued: Steam coming from the boiler through a valve A, Fig. 1, passed downward through piping B, which was surrounded by a water jacket, then after two short right bends traveled vertically, giving up, in its vertical portion a sample to a separating calorimeter CD; with one right bend again, steam after a short connection entered the horizontal separator G. Passing out of the separator the discharged steam gave up a sample to another separating calorimeter M on its way to the condenser, a surface condenser through which the steam passed, as water into a barrel to be weighed. In the last five runs, Nos. 14 to 18, the condenser was not used, but the flow of steam was measured by Napier's law; the steam flowing at higher pressures than before and at higher velocities through a measured nozzle.

In the runs after No. 11 the throttling calorimeter was used in addition, but did not prove satisfactory, the steam being quite too wet for accurate determination.

A is the valve connecting steam main with boiler, through which steam passes along the pipe and thus upwards. At B is a cold water jacket by means of which the steam to be used in the separator test was changed in quality. At C a steam nozzle took steam sample from the vertical pipe to a separating calorimeter D, and the steam's quality was thus known before passing into the separator. The steam gauge and throttling calorimeter F also checked this determination. The steam then passed through the separator G, and the drips were collected at L, the water level in the separator being kept constant. After passing the separator the steam was again sampled by the throttling calorimeter M, and the separating calorimeter J, and passed through the valve H, by means of which the velocity was controlled and changed on different runs. The steam condensed by the surface condenser was pumped to the barrel on the platform scales and weighed. The throttling calorimeter on the right was not used with the very wet steam. By using the valves of the drips L and K, and also the steam used by the calorimeter J, the separator itself was used as a check calorimeter. All apparatus was carefully calibrated before the runs.

From the general run of the results as shown on the table of qualities it would seem that runs 6 and 12 should be thrown out as being in all probability associated with some error of conditions or observations. If we do so we would conclude that this separator in good condition and for the higher velocities of steam flow will deliver steam of say 97 per cent dryness, and has little separating qualities in steam of drier quality. And we are quite safe in concluding that it will, if kept well drained, deliver a steam dry within three per cent. There seems to be little difference in its action for live steam from boiler and the exhaust steam, or steam of low pressure, of considerable wetness. The steam of three pounds above atmosphere, corresponding to ordinary engine exhaust, was, as will be seen from its quality in the table, made to contain by means of the jacket considerable moisture, and again made quite dry. The action, however, was similar to that for steam of higher pressure, and similar wetness, namely, to deliver steam of say 97 per cent, irrespective of original quality.

*Extracts from a paper read at the Washington meeting (May, 1899) of the American Society of Mechanical Engineers.

LOG OF TEST.

R'n	Time Minutes.	Pr'sure in Dry-steam Gauge above Atmosphere.	Pr'sure in Wet-steam Gauge above Atmosphere.	Water from Separator, Lbs.	Condenser steam, Lbs., net.	Wet-Steam Calorimeter.		Dry-Steam Calorimeter.	
						Water in Scale Lbs.	Water in Can Lbs.	Water in Scale Lbs.	Water in Can, Lbs.
1	12½	20¾	19.4	22.8	302.95	.083	2.5	Not	taken
2	Nt tk	34.8	34.3	37.75	307.5	.023	1.9	.045	1.51
3	11½	21.2	20	25	231.87	.16	2.05	.075	1.8
4	7	29.5	27.5	9	335.5	.07	1.4	.058	1.6
5	8	35.5	34	15.5	317.25	.1	1.6	.115	2.15
6	7	11.4	10.6	10	319.5	.08	1.15	.11	1.1
7	8½	16.5	15.8	12	367.25	.08	1.75	.06	1.45
8	6	29.3	29	10	343	.14	1.7	.115	1.65
9	8	86.1	86.6	26	322.75	.215	1.3	.059	1.7
10	9	83.1	83.6	33	365.5	.21	1.15	.09	2.45
11	12	1.3	1	12	355	.04	1.05	.057	.30

Run.	Time, Min't's	Pressure in Separator in Lbs. Gauge.	Separat'g Calorimeter		Throt'ng Calorimeter Temp.	Water from Separator, Lbs.	Condensed Steam Used, Lbs.
			Water in Can, Lb.	Water in Scale, Lb.			
12	19	3	.8	.02	212°	9	300
13	9	3.25	.35	.01	216°	16	154

Radiation at 3 pounds = 2.2 pounds for 8 minutes, = .27 pound per minute.
Oil separation: Oil put in 1.42 pounds, taken out .48 pound, per cent regained = 32 per cent.

LOG OF TEST WITH NOZZLE.

Run.	Time, Minutes.	Pressure, Lbs. Gauge.	Separating Calorimeter		Water from Separator, Lbs
			Water in Can, Lbs.	Water in Scale, Lbs.	
14	9¼	60	Not taken	.....	3.25
15	9¾	47.5	.65	.04	4.9
16	9¾	32	.65	.055	4.72
17	9	52.3	.....	.....	4.65
18	9¼	70.2	.9	.035	4.95

Radiation = 1.07 pounds in 10 minutes, = .107 pound per minute.
Pressure after leaving or at nozzle averages. 1.5 pounds gauge.

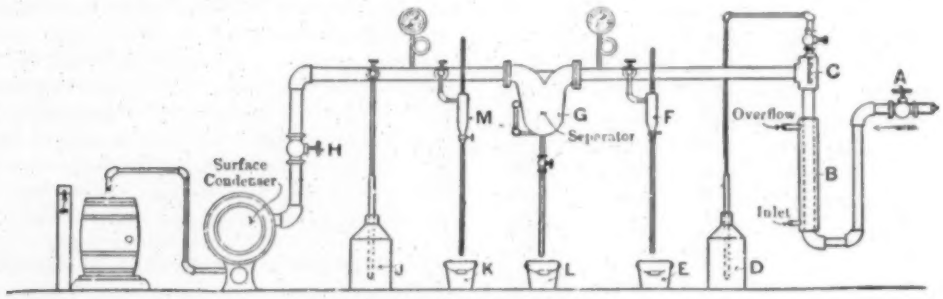


FIG. 1.—TEST OF A SEPARATOR.

QUALITY OF STEAM.

Run. No.	Before Entering Separator.	After Passing Separator.
1	.....	.....
2	89.2 per cent	97.1
3	93.2 "	96.1
4	95.2 "	96.5
5	94.1 "	96
6	93.5 "	91
7	95.7 "	96
8	92.4 "	93.2
9	85.4 "	96.6
10	85 "	96.4
11	96.3 "	97
12	97.5 "	99.7
13	95 "	.....
14	.....	.....
15	94.2 "	95.3
16	92.2 "	93.3
17	96.2 "	97.3
18	.....	.....

Steam Separator as an Oil Separator.

The apparatus before mentioned was used in the test as an oil separator. The calorimeters and their leading pipes, and all unnecessary attachments were removed, and a force pump, small pump oiler, was attached at the bottom of the first vertical pipe leading to the separator as described before.

A steam gauge was attached at a point beyond the separator, which recorded the pressure in the separator, and the steam was allowed to flow through and into the air, discharging as in ordinary practice in a non-condensing engine. The method pursued was, in brief, to pump a known amount of cylinder oil into the pipe leading to the separator, and to draw away from the separator through the drip at the bottom the oil and water separated from the steam on its passage. The per cent of efficiency of the arrangement would evidently be the ratio of the amount taken out to the amount put in, multiplied by 100.

This was done; a goodly supply of "vacuum" cylinder oil was pumped into the pipe slowly as it would be in working conditions in the engine manipulations, and the oil coming away with the water was carefully skimmed off and weighed. Much care was exercised in the beginning to see that a quantity of oil sufficient to oil all the parts between the pumps and separator was put in so that all interstices and joints might absorb or take up all that they might hold, and so to insure that no oil would be caught and held before entering the separator and after leaving the pump. In fact a run was made at first, which is not here recorded, which served as a zero point to begin observations.

It was found that it was impossible to skim the mixture of oil and water so carefully as to warrant saying that the skim was only oil, although to the eye there were no water globules present, but the specific gravity of the oil regained was much

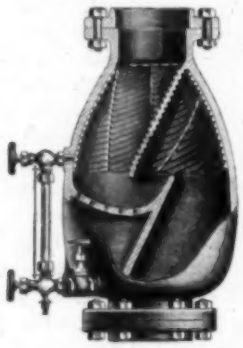


FIG. 2.—THE AUSTIN SEPARATOR.

heavier than that put in, and the weight of the mixture taken out was much greater than that of oil put in. The mixture was cooled to 60 degrees Fahrenheit, and from its weight and specific gravity was figured the probable weight of oil in the mixture. The water which existed in the oil, or mixture, is held in very small globules between the parts of the heavier oil, and therefore affects the specific gravity and weight directly in the proportion of its existence.

[Here follows in detail the method of calculating the oil regained. The result is summarized as follows:]

TESTS.

Run.	Oil Put in.	Mixture Taken Out.	Specific Gravity Mixture.	Per cent oil Regained.
1	1.86 lbs.	3.81	.930	58.6
2	3.05 "	5.1	.942	53
3	1.4 "	1.82	.940	42
Average.....				51.2

The specific gravity of the oil put into the pipe through pump was .893 at 60 degrees Fahr. These experiments prove that, in round numbers, 52 per cent of the oil, as pure oil, was regained, although the mixture which might be used for lubrication again was a much larger amount.

[The Austin separator horizontal type, was used in the tests detailed above. The illustration shown is of the vertical type of the same separator.—Ed.]

The Iroquois Iron Co. has bought from the estate of Douglas Taylor a tract of 1,200 feet of land extending from Ninety-sixth street, Chicago, south to the tracks of the Lake Shore Railroad and from the east line of the company's present property to the alley in the rear of Avenue L. The purchaser, it is reported, will construct a new blast furnace and docks on the river at an expenditure of $500,000. The Iroquois Iron Co., it will be remembered, bought the plant of the Iroquois Furnace Co. at South Chicago recently.

Pig iron production in Germany in the four months ending with April amounted to 2,658,443 tons, against 2,392,943 tons in the first four months in 1898.

THE BELL STEAM HAMMER.

The increasing use of steam hammers, not only in rolling mills and forges, but in the greater variety of work done in the blacksmithing department of iron works, has directed attention to the improvement of these tools. Their cost has been one obstacle to the introduction of hammers in ordinary smith's shops. But simpler designs combined with improved and economizing devices, have been introduced, leading latterly to an increasing use of power hammers. The Bell hammer, manufactured by the Bell Steam Engine Works, of Buffalo, is of strong and heavy construction, having a single column standard, with the bed plate and cylinder cast in one piece, except in the largest size. The ram is of forged iron, octagon in section, guided by a deep gland, piston and bushing, rendering slides unnecessary and leaving the dies in full sight of the operator. The hammers are single or double acting, taking steam at both ends of the stroke. A single lever gives desired variations in force, position, rapidity and length of blow.

There are four sizes of these hammers. No. 1 is for light blacksmith work, where short, quick heats on small work are required. Nos 2 and 3, the latter of which is shown in the illustration, are suited to general engine work and to the working up of old car axles, as well as the scrap found in

blacksmith shops. No. 4 will forge large and heavy cranks, shafts, etc., and may be employed in connection with a heating furnace to work up scrap into billets.

The No. 3 hammer has a 10-inch cylinder, a 22-inch lift, a 2-inch steam pipe and a 2½-inch exhaust pipe. The blow that can be struck is estimated at 80 pounds steam pressure, but the hammer will work satisfactorily from 40 pounds upward. It will strike a blow of 6,000 pounds and 150 blows a minute. The average diameter of the shaft that can be beaten out at a single heat is 7 inches.

Special uses to which the No. 2 and No. 3 Bell hammers are being put are: Jumping and welding legs on locomotive frames; upsetting the ends of rock drills; splitting wood in making wood alcohol; welding 2x4-inch steel rings 12 to 24 inches in diameter; flattening iron tubes and pipes to save bulk in transportation; breaking pig iron. The hammer may be fitted to run by compressed air and several are in successful operation by this power. For a number of months shipments of these hammers from the Bell works have been at the rate of one a week, many of the orders coming from firms already using the Bell hammer.

The Vulcan, the machine shop ship used with so much success during the war with Spain, will be sold by the navy department. The vessel was fitted out at the Boston Navy yard and did a vast amount of work under Acting Engineer G. C. Sims. Experts have appraised the ship at $100,000.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Pennsylvania Car Wheel Co., Pittsburg, will buy floor cranes and wheel flasks.

G. B. Herenden and Willis L. King, of Pittsburg, bought the New Castle, Pa., Engineering Works last week for $90, subject to mortgage of $85,000.

The Albany Boiler Works, which are to be removed from Albany, N. Y., to Green Island, near Troy, have increased the capital to $100,000. The Franklin Iron Works plant will be utilized. Considerable purchases are to be made. Harry L. Van Zile was chosen president and Frank Chrysler, secretary.

The Tower-Binford Electric & Mfg. Co., Richmond, Va., is in the market for a hollow-spindle engine lathe, 14-inch swing and six-foot bed, upright power drill press and small milling machine.

The Atlantic Chemical Co., F. S. Royster, president, Norfolk, Va., will buy a second-hand iron lathe to take in a 20-inch pulley and 12 inch shaft.

The city electrician of Chicago will open bids June 21 for erecting two steel stacks.

The Arthur Fritsch Foundry & Machine Co., filed an application for incorporation at St. Louis. The stockholders are Arthur Fritsch Lydie Fritsch and Charles Weber.

New Construction:—

The Scranton Nut & Bolt Mfg. Co., Scranton, Pa., has purchased five acres of land from the Lackawanna Iron & Coal Co., and construction work will begin at once.

The Malleable Iron Works, New Britain, Conn., will build a foundry addition 40x60 feet.

The plant of the Syracuse, N. Y., Tube Works, now a part of the National Tube Co., is to be enlarged and its capacity increased nearly 50 per cent.

The Chisholm & Moore Mfg. Co., Lake and Kirtland sts., Cleveland, manufacturer of chain hoists, cranes, etc., has purchased the new plant in course of erection for the Garry Iron & Steel Roofing Co., Cleveland, on Lake st., between Kirtland and Coe sts., and adjoining the present property of the former company. The entire property has a frontage on Lake st. of 501 feet and extends back 330 feet to a switch of the Pennsylvania Railroad. The main building, which is 100x318 feet, will be used for a malleable iron foundry, and a building 60x190 feet adjoining it, will be used by the annealing and shipping departments. The new buildings have been made necessary by the fact that the company has purchased the business of the American Rail Joint Mfg. Co., Cleveland. The Garry Iron & Steel Roofing Co. will erect another building for its own use.

Fires and Accidents:—

A large fly-wheel burst at the mill of John Wood, Bros. & Co, Conshohocken, Pa., on June 6 A segment weighing three tons did great damage in the mill.

At Butte, Mont., the Western Iron Works plant burned June 6, with $80,000 loss.

The Milwaukee Bridge & Iron Works, Milwaukee, were damaged $20,000 by fire.

The rolling mill of Norton Brothers' tin can factory in Maywood, Ill., where 1,300 men are on a strike, was burned June 11. The loss is $10,000. It is claimed the fire was started by strikers.

Power Equipment and Machine Tools:—

Recent sales of the Cochrane separators of the Harrison Safety Boiler Works, of Philadelphia, have been made to the following concerns: Carnegie Steel Co., Pittsburg, three 16-in. and one 10-in.; Laughlin & Co., Ltd., Pittsburg, six 5-in. five 10-in., one 7-in., one 4-in., two 6-in., and two 12-in.; Cambria Steel Co., Johnstown, Pa., two 12-in.; Law Bldg., Chicago, two 5-in.; Jas. Clements & Son, Bay City, Mich., 8-in. and 3½-in.; Franklin Mining Co., Hancock, Mich., 14-in. and 6-in.; Cedar Rapids, (Ia.) Elec. Lt. & Pr. Co., 12-in.; Cunard Steamship Co., New York, 4-in. and 4½-in.; Haverhill (Mass.) Elec. Co., 7-in.; American Blower Co., London, Eng., 4-in.; Gisholt Machine Co., Madison, Wis., 14-in.; Monongahela Furnaces, McKeesport, Pa., 2-in. and 2½-in.; Alcania Co., Avonmore, Pa., 16-in.; Brier Hill (Ohio) Iron & Coal Co., two 12-in.; E. W. Blatchford Co., Chicago, 5-in; Flossett Mfg. Co., Pawtucket, R. I., 3-in.; National Tube Works, McKeesport, Pa., 3-in.; Denver (Col.) Engineering Works Co., 4½-in. and 5-in.; B. F. Smith Co., Pawtucket, R. I., 4-in., Norton Bros., Maywood, Ill., 6 in.; Mills, Horton & Reed, Providence, R. I., 4-in.; De La Vergne Refrigerator Machine Co., New York, 5-in.; Carman-Thompson Co., Lewiston, Me., 3½-in.; Carbondale (Pa.), Machine Co., 3-in.; Ward & Huntington, New York, 6-in. horz.; Kress Box Co., Pittsburg, 6-in.

The Turner Engineering Co., of Bucyrus, O., will erect a complete boiler plant, for the Marion Steam Shovel Co., Marion, O., the order including a large self supporting steel stack, brick lined, after special designs. The Marion Steam Shovel Co. sends its shovels and dredging machinery to all parts of the world, and its plant has the most modern labor saving devices.

Wm. Tod & Co., the well known Youngstown, O., engine builders, have an order from the Youngstown Steel Co. for a blowing engine, with 80-inch steam cylinders, 84-inch blowing cylinders, 60-inch stroke, to run as low pressure in connection with a high pressure engine.

The plan originally mapped out for the combination of the Niles Tool Works Co. with several other machine tool concerns has been changed somewhat. It was at first intended to form a company with a capital of $12,00,0000 equally divided between common and preferred stock to take in the Niles Tool Works Co., the Pond Machine Tool Co., Bement, Miles & Co., and the Philadelphia Engineering Works. The plan as now determined upon will be the issue of $5,000,000 common and $3,000,000 preferred stock, a total of $8,000,000. It was the intention at first to put a large amount of the stock on the market, and arrangements were made for the underwriting on the basis decided upon by prominent New York houses. According to the change in the plans there will be none of the common and but $500,000 of the preferred to be taken, all the remainder, the bulk of the capital, being taken by those in the deal. Of the $500,000 preferred left for subscription half has been taken already, leaving in reality but $250,000 to be subscribed. The prospects of the new combination of the four large concerns engaged in the manufacture of heavy machine tools are bright, and the organization is to be perfected on a basis that will insure the 6 per cent guaranteed on the preferred stock and leave a full 15 per cent for the common.—[Cincinnati Enquirer.

The American Pneumatic Tool Co., of New York City, has sold to the National Pneumatic Tool Co, of Philadelphia, the right to manufacture pneumatic tools for use in the metal trades. The National Pneumatic Tool Co. pays a considerable sum for this right, which is to be exclusive except as regards the American Pneumatic Tool Co, which will continue to make and sell pneumatic tools for all purposes as heretofore. It is stated that this right was purchased by the National company upon advice of counsel.

A complete machine shop tool equipment for the Odawara Electric Railway Co., of Odawara, Japan, has recently been shipped by the Peckham Motor Truck & Wheel Co. Among some of the large pieces sent were a 150-ton hydraulic press, car wheel borers, a 20-inch stroke shaper, a double-head car wheel grinder, various sized lathes, pneumatic hoists, etc.

The Brown Hoisting & Conveying Machine Co., of Cleveland, is shipping a large crane to La Societe d'Ougree of Liege, Belgium. The entire shipment of this tool occupied five car loads.

The Edward P. Allis Co. has secured the contract to build a blowing engine for the Sulin Iron & Steel Co., at Sulin, on the River Don, Russia. The engine will weigh upwards of 350 tons and cost $50,000 Other contracts just booked by this company are four engines, one each to Bristol and London and two for Cork.

General Industrial Notes:—

The lockout and strike at the Tudor Iron Works, St. Louis, are still on. The management insist that the plant shall not be run as a union mill; the strikers demand recognition of

FOR HORZ. PIPE.

THEY'LL DO IT!

THAT'S ALL.

We can fully recommend our Cochrane Oil Separators to thoroughly purify exhaust steam from oil—our Cochrane Steam Separators to give Dry Steam—our Cochrane Heaters to heat and really purify water for boiler feed purposes.

Their Design Pleases Mechanical Men, and We Stand Back of the Workmanship and Material---THAT'S ALL

UNLESS YOU WRITE

HARRISON SAFETY BOILER WORKS,

Clearfield and Seventeenth Streets,

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FOR VERT. PIPE.

the Amalgamated Association. The question of unionizing all the plants of the Republic Iron & Steel Co. is pending. It is possible that some of the plants will be closed if the line is drawn too stringently.

Etna Furnace at Ironton, O., operated by the Marting Iron & Steel Co., made its first cast June 6.

Some capitalists are negotiating for the purchase of the small plant at Greensburg, Pa., built in 1890 by the Greensburg Steel Co., and operated afterward for a short time by the Pittsburg Tool Steel Co. The plant contains several furnaces, a crucible steel melting furnace, and two trains of rolls.

The electric equipment recently contracted for by the National Steel Co. for the Mingo Junction works is completed. The power plant includes two 150 kilowatt generators, direct connected to two 225 h. p. engines, and furnishing current at 250 volts. The current is to operate nine electric traveling cranes and will also supply light to the mill and office, besides operating the tables.

It is the intention of a new company just incorporated in Delaware to start the furnace and rolling mill at Oxford, N J., on the line of the Delaware, Lackawanna & Western Railroad, and owned by the road.

The Peoria Steel & Iron Works, Peoria, Ill., have passed from the hands of the local company into the control of the Republic Iron & Steel Co. The reported consideration is $1,250,000.

Two of the American Steel & Wire Co.'s Jolliet, Ill., mills will be closed down to sort stock preliminary to inventory.

The Cambria Steel Co. now employs 8,200 men, the largest number in its history.

The Muncie Foundry & Machine Co., Muncie, Ind., has completed the addition of $25 000 worth of new equipment. The foundry facilities have been increased to take on 30 more men.

The Watts Steel & Iron Syndicate's properties at Middlesboro, Ky., are reported to have been withdrawn from the Virginia Coal, Iron & Coke Co. consolidation the syndicate suing for a recession of its contract of sale. The consideration is said to have been $1,200,000.

The plant of the Valley Iron Works, at Appleton, Wis., was sold by Receiver W. A. Fannon to A L. Smith, Jr., the heaviest creditor of the old company. It is said that the company will be reorganized.

W. H Nelson, manager, has been trying to devise some way of securing water for the Excelsior Furnace, at Ishpeming, Mich., so that it can resume, but thus far has not decided upon the plan.

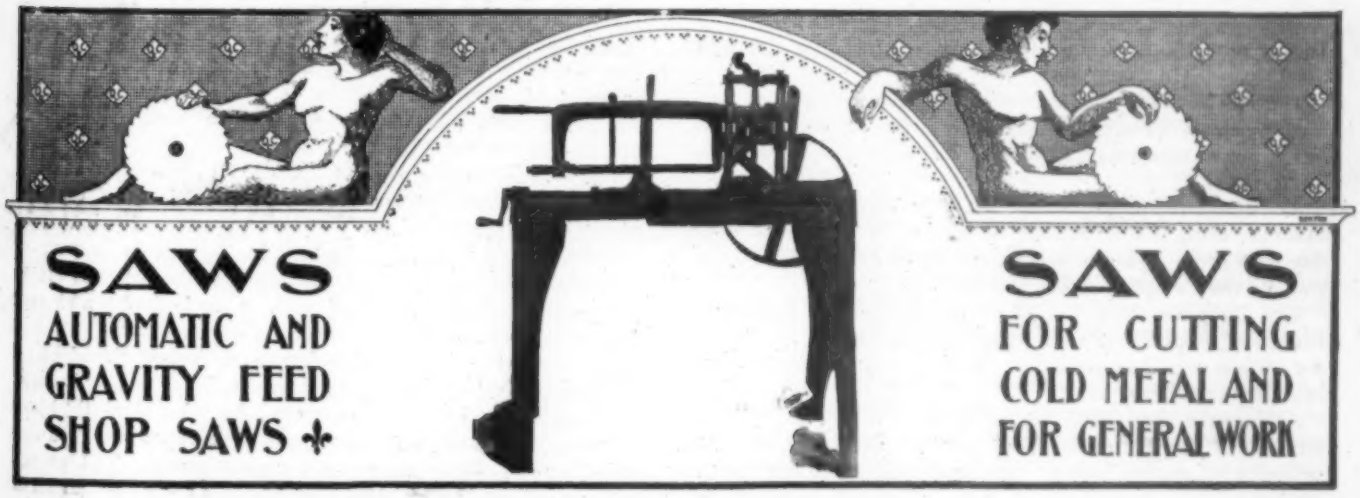
The Solid Steel Casting Co., of Chester, Pa., has started the plant at Chester, idle for several years. Officers of the Pennsylvania Steel Co. and the Maryland Steel Co. are at the head of the new enterprise.

The Sharpsville Foundry, at Sharpsville, Pa., has passed into the hands of a new company, which includes R. W. Davis, of Warren, O.; Frederick Russell, of Pittsburg, and several Sharon parties. The plant has been idle about two years. It will start up at once.

The puddling department of the Sharon, Pa., works of the National Steel Hoop Co., idle for nearly five years, will be put in operation as soon as repairs are made, and will employ 300 men

The Addyston, O., plant of the United States Cast Iron Pipe & Foundry Co., has announced a 10 per cent advance in wages. It is expected that the Newport, Ky., plant of the consolidation will be operated for a time at least.

At the annual meeting of the Cumberland (Md) Steel Tin Plate Co., held in Camden, N. J., the following officers were elected: President, H. H. Dickey formerly secretary of the company; vice-president, W. M. Gordon, formerly receiver of the Pottstown Iron Co.; treasurer, Edward Bailey, president of the Harrisburg National Bank; secretary, Wm. C.



MOUNT SAVAGE FIRE BRICK.

UNION MINING CO,

Proprietors of the CELEBRATED Mount Savage Fire Brick

GOVERNMENT ⁞ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

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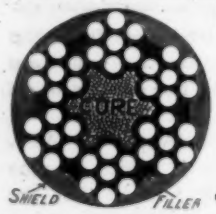

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Dickey, now located in the New York office of the Cambria Steel Co.

There is some movement to start up the plant of the Kellogg Weldless Tube Co., Findlay, O. Wm. H. Heckert, who has seamless tube patents, is mentioned in connection with the effort.

At Baltimore, proprietors of all the shipyard and boiler manufacturing plants refused to grant the nine-hour work day with present pay for ten hours, except R. M. Spedden & Co. and the Campbell & Zell Co.

The Laughlin Nail Co., Martin's Ferry, O., abandoned the use of muck bar in 1886. The demand for iron cut nails for certain uses has increased lately and the company will rebuild its puddling plant.

Application has been made to have Receiver William Atkins, of the Pottsville (Pa.) Iron & Steel Co., sell the property at auction July 5. The plant was built in 1852 to make rails, and was rebuilt in 1872. The sale is made on account of default of mortgages. There are 12 heating furnaces and four trains of rolls (one 12, two 19, and one 23-inch). The annual capacity of iron and steel beams, channels, angles, tees, bars, and shafting, is 35,000 gross tons. The steel department contains two 20-gross-ton basic open-hearth furnaces, which were built in 1890.

The Wilkes Rolling Mill at Sharon, Pa., has been started up to furnish muck bar for the Sharon Iron Works of the Republic Iron & Steel Co.

The Crumlish Forge Co., Buffalo, N. Y., reports that it is rushed with orders for its Crumlish portable forges. It is making daily shipments to its trade in the United States and also has a goodly number of foreign orders on hand.

The trustees for the bondholders have leased the dock of the Lehigh Coal & Iron Co., at Superior, Wis., to the Duluth Furnace Co., which recently acquired the West Duluth blast furnace. The lease is for three years and includes all the dock property, the coke ovens and the equipment. The lessees will operate the coking plant to supply coke for its furnace. A portion of the dock recently burned will be rebuilt and used

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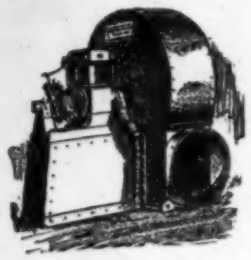

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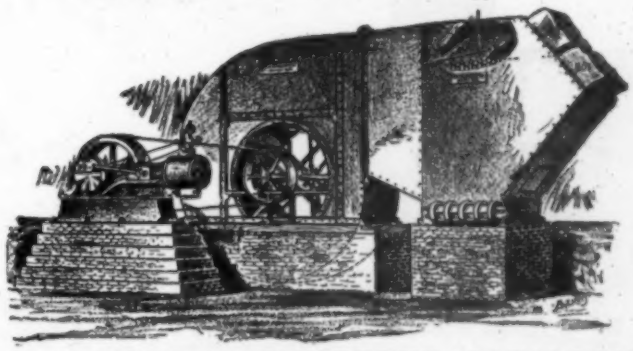

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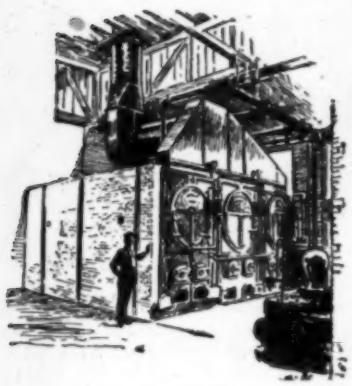

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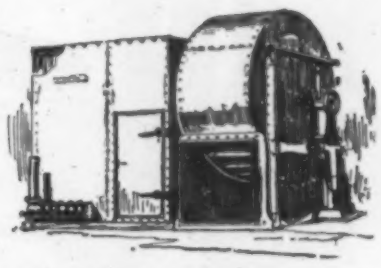

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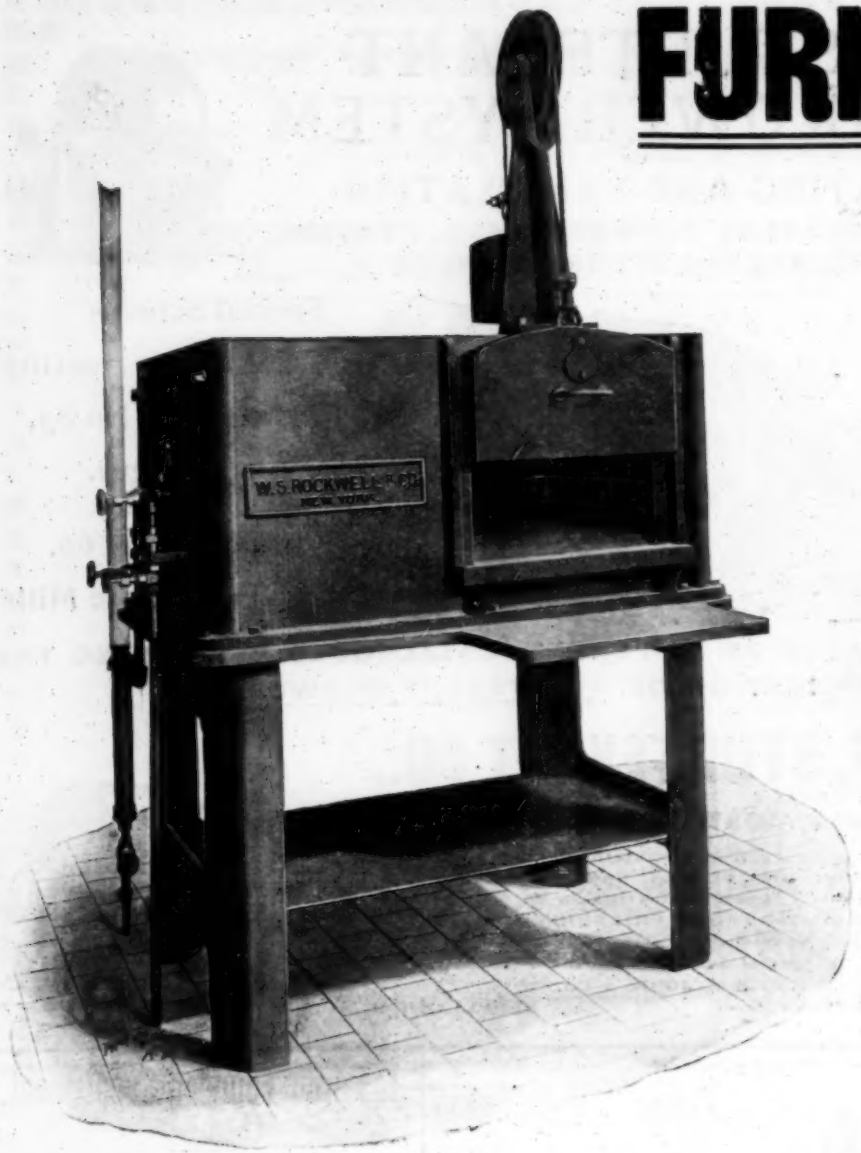

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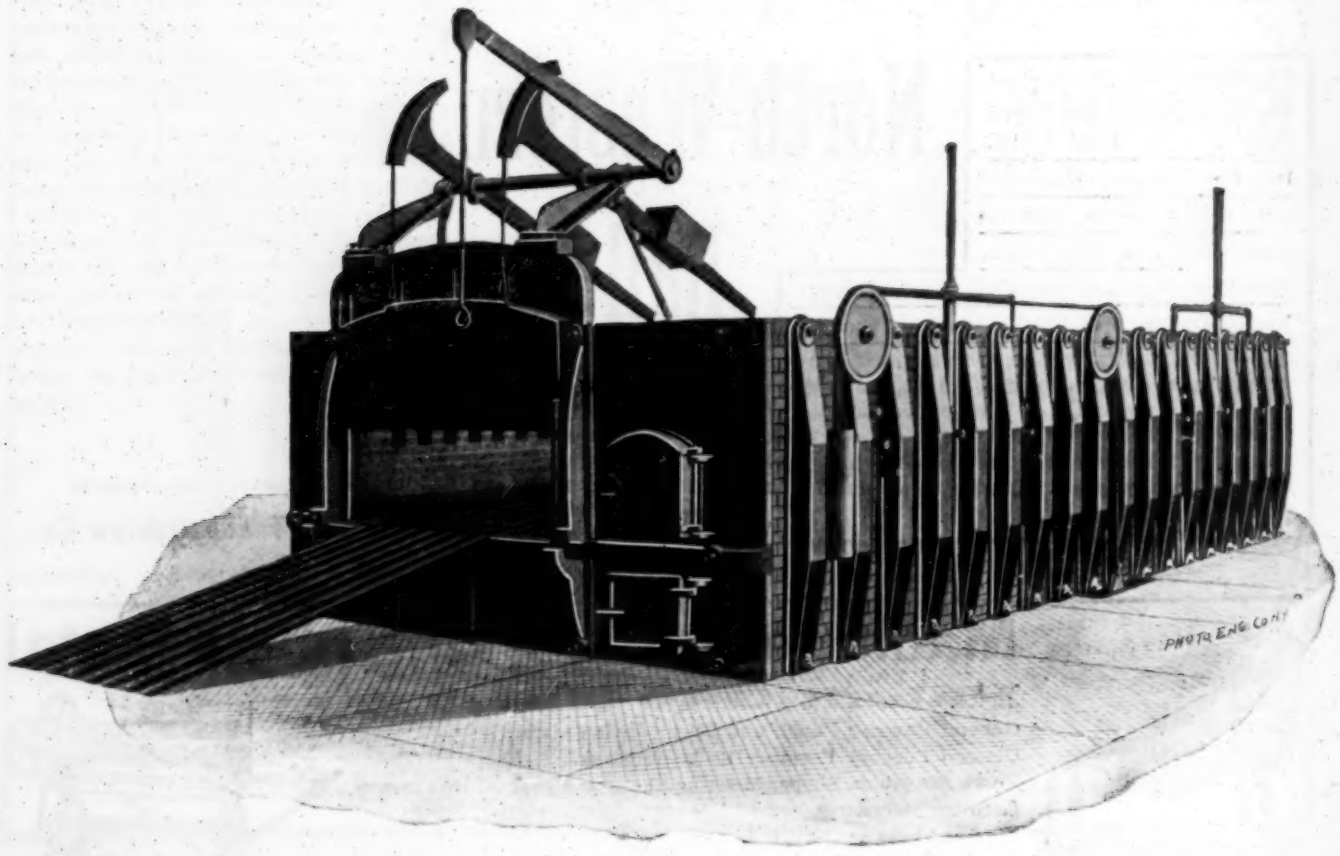

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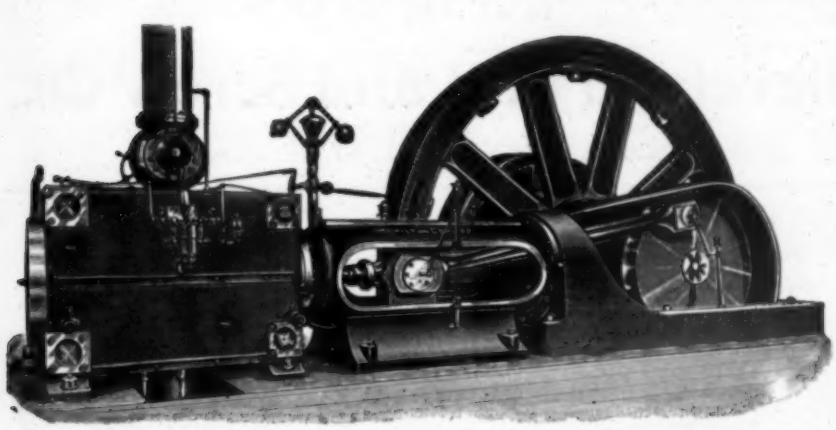

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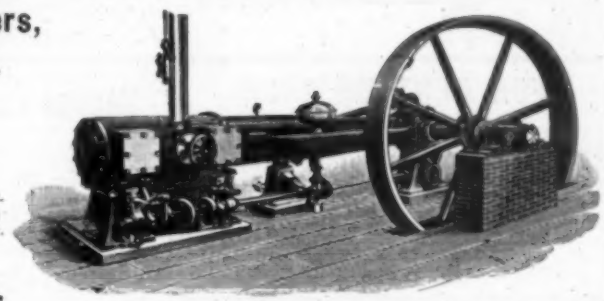

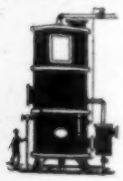

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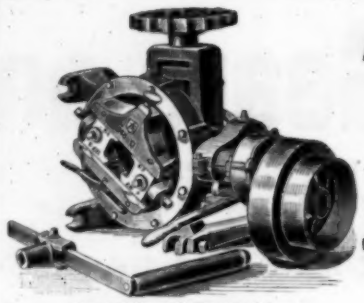

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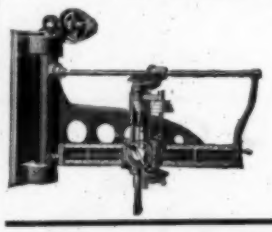

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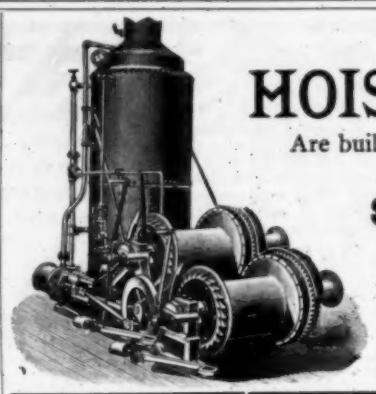

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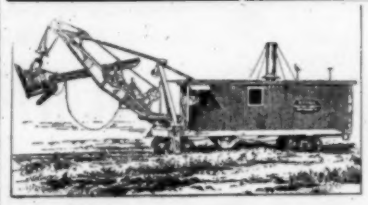

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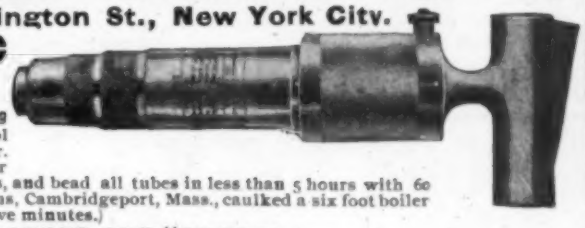

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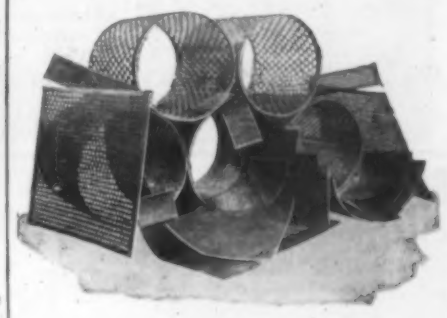

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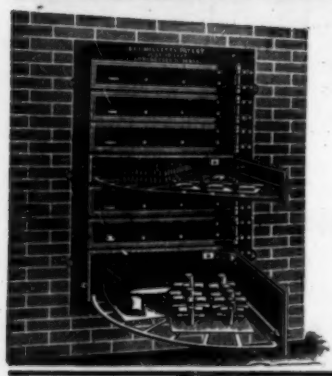

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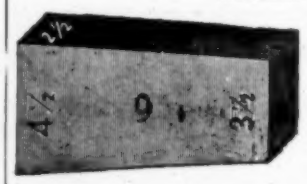

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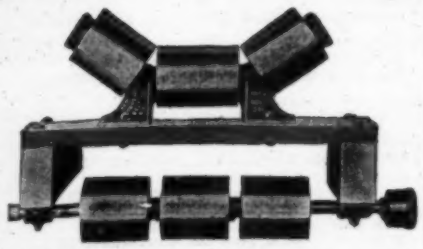

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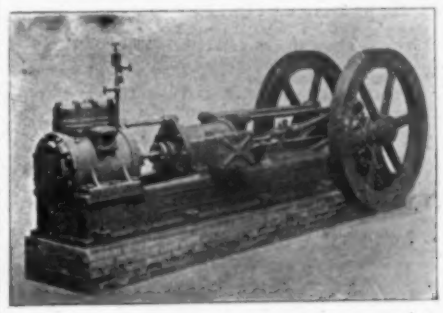

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Danielson Machine & Tool Co., Cleveland, O.

Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

Drill Grinders—
J. Wendell Cole, Columbus, O.

Drill Presses—
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.
Fox Machine Co., Grand Rapids, Mich.
Bickford Drill & Tool Co., Cincinnati, O.
Cleveland Tool & Supply co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

Drop Forgings—
Wyman & Gordon, Worcester, Mass.

Drop Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
Fox Machine Co., Grand Rapids, Mich.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.

Dry Kilns—
B. F. Sturtevant Co., Boston.

Dynamos—
Jeffrey Mfg. Co., Columbus, O.

Eave Troughs and Conductors—
Berger Mfg. Co., Canton, O.

Elevators—
The Lane & Bodley Co., Cincinnati, O.

Elevating and Conveying Machinery—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
Sprocket Chain Mfg. Co., Detroit, Mich.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

Emery and Corundum Wheels—
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland. O.
W. P. Davis Machine Co., Rochester, N. Y.

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O

Engineers and Contractors—
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville Ohio.
E. E. Erickson, Pittsburg, Pa.
Benedict Crowell, Cleveland, O.
John T. Jones & Co., Chicago, Ill.
Riter-ConleyMfg. Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

Engine Packing—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.

Engineers' Supplies—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Engine Lathes—
U. Baird Machinery Co., Pittsburg, Pa.

Engines (Oil)—
The Aultman Co., Canton, O.

Engines (Steam)—
W. P. Davis Machine Co., Rochester, N. Y.

Wm. Tod & Co., Youngstown, O.
B. F. Sturtevant Co., Boston, Mass.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.
I. & E. Greenwald Co., Cincinnati, O.
Webster Camp & Lane Machine Co., Akron, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

Engravers and Electrotypers—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.,

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.

Fans—
American Gas Furnace Co., New York City.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield,
Dover Fire Brick Co., Cleveland. Pa.
F. B. Stevens, Detroit, Mich.
The S. Obermayer Co., Cincinnati, O.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit. Mich.
Garden City Sand Co., Chicago, Ill.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.

Flexible Shafts—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Flue Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Foot and Power Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa

Foundries—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.

Foundry Equipments—
The S. Obermayer Co., Cincinnati, O.

Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland. O.
The S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Foundry Facings—
The S. Obermayer Co., Cincinnati, O.
Cleveland Facing Mill Co., Cleveland, O.

Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Iron Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.

Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.

Furnaces—
Playford Stoker Co., Cleveland, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

Fuel Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.

Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizers—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizing Pots—
The Wm. B. Pollock Co., Youngstown, O.

Gas Burners—
American Gas Furnace Co., New York City.

Gas Furnaces—
American Gas Furnace Co., New York City.

Gauge Cocks—
James Bonar & Co., Pittsburg, Pa.

Gearing.
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutting—
The R. D. Nuttall Co., Allegheny, Pa.
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.

Gear Lubricants—
The Ironsides Company, Columbus, O.

Grease—
A. F. Boettcher, Rowlands, Pa.

Grindstones—
C. H. Besly & Co., Chicago, Ill.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,

Grate Bars—
Geo. B. Sennett Co., Youngstown, Ohio.

Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O
Brass Founders' Supply Co., Newark, N. J.

Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.

Hangers—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.

Hoists—
Edwin Harrington Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, C.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

Heating and Ventilating Apparatus
B. F. Sturtevant Co., Boston.

Heavy Hardware—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Karle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
Excelsior Iron Works Co., Cleveland, O.
Karl C. Bacon, New York City.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Co., New York City.

Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.

Hotels—
United States Hotel Co., Cleveland, O.

Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

Impulse Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Ingot Molds—
Lorain Foundry Co., Lorain, O.

Injectors—
C. H. Besly & Co., Chicago, Ill
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.

Iron Nails and Steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Iron and Steel Roofing—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O

Iron Ore—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland. O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

Iron Working Tools—
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
The F. B. Shuster Co., New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Brainard Milling Machine Co., Hyde Park, Mass.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Ball & Screw Co., Cleveland, O.
W. P. Davis Machine Co., Rochester, N. Y.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

Ladles—
The S. Obermayer Co., Cincinnati, O.

Lathes—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

Lubricators—
A. F. Boettcher, Rowlands, Pa.

Machinery Name Plates—
August Becker, Boston, Mass.

Machinists' Tools and Supplies—
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

Machine Screws—
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.
H. A. Streeter, Chicago, Ill.

Machinery and Tool Steel—
C. H. Besley & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Malleable Castings—
Acme Malleable Iron Works, Buffalo, N. Y.

Manufacturing Chemists.
We Fu Go Co., Cincinnati, O.

Manufactured Iron & Steel—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.

Metal Bearings—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.

Milling Machines—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, NewYrok City.

Mining Machinery—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Karle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

Mine Pumps—
F. M. Prescott Steam Pump Co, Milwaukee, Wis.

Molding Machines—
Tabor Mfg. Co., Elizabeth, N. J.

Molding Sand—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Molders' Tools—
The S. Obermayer Co., Cincinnati, O.

Name Plates—
August Becker, Boston, Mass.

Nickel Plating Outfits—
Northampton Emery Wheel Co., Chicago, Ill.

Nuts and Bolts
Upson Nut Co., Cleveland, O.

Oilless Bearings—
C. H. Besly & Co., Chicago, Ill.

Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas FurnaceCo., New York City.

Oil Cups—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Oil Filters—
James Bonar & Co., Pittsburg, Pa.
Oil Pumps—
C. H. Besly & Co., Chicago, Ill.
Oil Separators—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Ore Screens—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Paint—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York, City.
The Shearer-Peters Paint Co., Cincinnati, O.
Pattern Works—
Gobeille Pattern Co., Cleveland, O.
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Pig Iron—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Pipe Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Pipe Covering—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Pipe Cutting and Threading Machines—
The Armstrong Mfg. Co., Bridgeport, Conn.
Planers—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
Plates—
Enterprise Boiler Co., Youngstown, O.
Plumbago—
The S. Obermayer Co., Cincinnati, O.
Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.
Pneumatic Appliances—
Clayton Air Compressor Works, New York.
Pneumatic Tools—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.
Portable Forge—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.
Power Presses—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Power Transmission Machinery—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Pressure Gauges—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.
Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Pumps (Steam)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill,
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Punches—
E. Konigslow & Bro. Cleveland, O.
Pyrometers—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.
Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Rivets—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.
Riveted Steel Pipe—
The Wm. B. Pollock Co. Youngstown, O.
Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

Rolling Mill Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
P. R. Phillips' Sons Co., Philadelphia, Pa.
Roofs—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Sand and Chill Rolls—
Seaman, Sleeth Co., Pittsburg, Pa.
Saws—
Peter Geriach & Co., Cleveland, O.
Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Screws—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill
Screw Machines—
Cleveland Ball & Screw Co., Cleveland, O.
Seamless Tubes—
Shelby Steel Tube Co., Cleveland, O.
Separators—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
Shafting—
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Shapers—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
Fox Machine Co., Grand Rapids, Mich.
Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Danielson Machine & Tool Co., Cleveland, O.
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.
Ship Yards—
Wm. Cramp & Sons, Philadelphia, Pa.
Special Machinery—
Edwin Harrington Son & Co., Philadelphia
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
Stand Pipes—
The Wm. B. Pollock Co., Youngstown, O.
Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.
Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.
Steam Packing—
C. H. Besly & Co., Chicago, Ill.
Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Steam Separators—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa.
Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Steam Specialties—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Steel—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Steel Balls—
Cleveland Ball & Screw Co., Cleveland, O.
Steel Castings—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Steel Plants—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.
Steel Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland, O.
Steel Tubes—
Shelby Steel Tube Co., Cleveland, O.
Stokers—
Playford Stoker Co., Cleveland, O.
Tanks—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Tank Cars—
The Wm. B. Pollock Co., Youngstown, O.
Tin and Terne Plates—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.

Tin Plate Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
P. R. Phillips' Sons Co., Philadelphia, Pa.
Tool Steel—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Transmission Machinery—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Tubes—
National Tube Works, McKeesport, Pa.
Shelby Steel Tube Co., Cleveland, O.
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Union Boiler Tube Cleaner Co., Pittsburg, Pa.
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S. Pix Sons, Cleveland, O.
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The S. Obermayer Co., Cincinnati, O.
Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland, O.
Twist Drills—
C. H. Besly & Co., Chicago, Ill.
Twist Drill Cases—
Vulcan Mfg. Co., Pittsburg, Pa.
Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Manning, Maxwell & Moore, New York City.
James Bonar & Co, Pittsburg, Pa.
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B. F. Sturtevant Co., Boston Mass.
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Massey Vise Co., Chicago, Ill.
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We Fu Go Co., Cincinnati, O.
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The Ironsides Company, Columbus, O.
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The Ironsides Company, Columbus, O.
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Wire Nails—
Cleveland Rolling Mill Co., Cleveland, O.
Wire Rope Coating.
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BRÆBURN STEEL COMPANY, Bræburn, Pa.

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FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

DIRECTORS: Wm. Metcalf, Chas. Metcalf, P. B. Hasbrouck, R. P. Kelly, Sec'y. and Treas.

MORE WEAR from your tools

.....Almost no **STEEL EXPENSE**

NO TROUBLE

"It pays to use the most reliable tool steel in the market."

SANDERSON BROS. STEEL, CO.

Cleveland Warehouse, 97 Water St.

CRESCENT STEEL
ESTABLISHED 1865 ✠ INCORPORATED 1889.
CRESCENT STEEL CO.
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CRUCIBLE CAST TOOL STEEL.

SPECIAL GRADES FOR ALL PURPOSES.

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COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING BLANKING DRAWING SPRINGS ETC
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THE GOBEILLE PATTERN CO., Cleveland.

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The Popular Line.

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Cincinnati,

Louisville

AND ALL POINTS

SOUTH AND SOUTHEAST.

The scenic line to

WASHINGTON, via C. & O. Ry.

The direct line to ASHEVILLE, N. C.

J. C. TUCKER, G. N. A., 234 Clark St., CHICAGO.

The Chemical Analysis of Iron.

A Complete Account of all the best-known Methods for the Analysis of Iron, Steel, Pig Iron, Iron Ore, Lime-stone, Slag, Clay, Sand, Coal, Coke, and Furnace and Producer Gas. By ANDREW ALEXANDER BLAIR. **New (Third) Edition.** Illustrated. 8vo. Half Morocco, $4.

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Cleveland, Ohio, U.S. A.

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All standard and special grades.
In sectional molds or bars.

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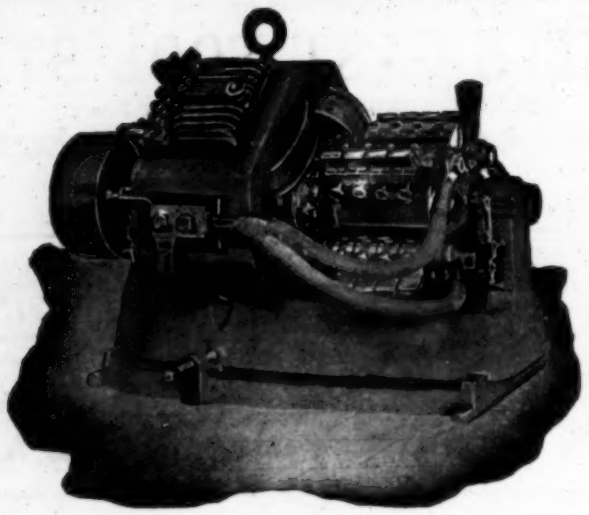

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EXCLUSIVE WESTERN SELLING AGENTS.

Leviathan Belting.

Tested under the hardest possible conditions and proved by years of service to be the best belt

For Heavy Driving of All Kinds.

Proof against Heat, Steam and Water.

Strength Durability, and Traction Power Unequalled.

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MAIN BELTING CO.

1219-1235 Carpenter St., PHILADELPHIA.
55 and 57 Market St., CHICAGO.
120 Pearl St., BOSTON.

Send for Price Lists and Samples

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And Lace Leather.

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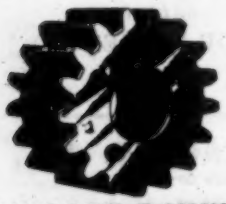

Rawhide Rope, Pinions, Picker Leather, Halters, Bell and Register Cord, and other Rawhide Goods of all kinds.

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CHICAGO RAWHIDE MFG. CO., 75-77 Ohio St., CHICAGO, ILL.

Advertisers who "keep everlastingly at it" win success.
That is the testimony of the shrewdest and livest of them.

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IRON ORE.

[On Lake Erie docks.]

Special low-phosphorus hard Ore, Bessemer	$4.50
No. 1 Specular, Bessemer	$3.50@ 4.75
No. 1 Bessemer hematite	3.00@ 4.00
Hematites No. 1 non-Bessemer	2.25@ 2.75
No 1. Specular, non-Bessemer	2.50@ 2.75
Mesabi Bessemer	2.50@ 3.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$ 6 65
No. 1 Strong Foundry	$16 75@17 00
No. 2 Strong Foundry	16 15@16 65
Gray Forge, red short	15 25@15 50
Gray Forge, neutral	15 15
No. 1 American Scotch	16 75@17 00
No. 2 American Scotch	15 15@16 65
Lake Superior Charcoal	17 00@18 00
PITTSBURG:	
No. 1 Foundry	$16 25@ 16 75
No. 2 Foundry	15 75@16 00
Gray Forge	14 75@ 15 00
Warm Blast Charcoal	18 00@ 19 00
Cold Blast Charcoal	24 00@ 26 00
Bessemer	17 00@ 17 50
CHICAGO:	
Lake Superior Charcoal	$17 00@18 00
Local Coke Foundry No. 1	15 50@ 15 75
Local Coke Foundry No. 2	15 00@ 15 50
Local Coke Foundry No. 3	14 50@ 14 75
Local Scotch Foundry No. 1	15 50@ 15 75
Local Scotch Foundry No. 2	15 00@ 15 50
Local Scotch Foundry No. 3	14 50@ 14 75
Southern Coke No. 1	16 00@ 16 25
Southern Coke No. 2	15 25@ 15 75
Southern Coke No. 3	14 75@ 15 00
Southern No. 1 Soft	15 50@ 16 00
Southern No. 2 Soft	15 00@ 15 50
Southern Silveries	15 50@ 16 00
Jackson Co. Silveries	17 00@ 18 00
Ohio Silveries No. 1	@
Ohio Strong Softeners	15 50@ 16 50
Alabama Car Wheel	17 50@ 18 00
Malleable Bessemer	15 50@ 16 00
Coke Bessemer	15 50@ 16 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$14 75@ 15 25
Southern Coke No. 2 and No. 1 Soft	14 25@ 14 75
Hanging Rock Charcoal No. 1, Fdy	17 00@ 18 00
Tennessee Charcoal No 1	15 00@ 16 00
Jackson County Silvery No 1	16 00@ 16 25
Southern Coke, Gray Forge	12 75@ 13 00
" " Mottled	12 75@ 13 00
Standard Georgia Car Wheel	15 50@ 16 00
Lake Superior " "	15 50@ 16 00
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$14 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 75
Ohio Strong Softener No. 1	14 00
Ohio Strong Softener No. 2	13 50
Jackson Co. Silvery No. 1	15 60
Southern Soft No. 1	15 25
Southern Soft No. 2	14 75
Lake Superior Charcoal	14 00@ 14 50
Coke, Malleable	14 10
ST. LOUIS:	
Southern Coke No 1	$14 75
Southern Coke No. 2	14 25
Southern Coke No. 3	13 75
Southern Coke No. 4	13 55
Southern Gray Forge	13 20
Tennessee Charcoal No. 1	13 75
Jackson County 8 per cent Silicon	16 25
Lake Superior Coke No. 1	15 00@ 16 00
Southern Car Wheel	15 25@ 16 25
Genuine Connellsville Coke	4 15
West Virginia Coke	4 10

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$18 00
Old steel rails (6 ft. and over)	14 00
Old steel rails (6 ft. and under)	14 00
Old car wheels	16 00
	Net Tons
No. 1 R. R. wrought scrap	$16 0
Mill scrap	11 50
No. 1 Machine cast scrap	12 50
Iron axles	19 00
Axle turnings	11 00
Wrought turnings (free from cast)	10 00
Cast borings	7 50
Uncut wrought iron boilers	7 00
Steel boiler plates	11 00
Grate bars	8 00
Pipes and flues (clean)	10 00
Tank iron	12 00
Hoop and band iron	9 00
Sheet iron	8 00
Wrought drillings	10 00
Malleable iron	10 50

STRUCTURAL MATERIAL.

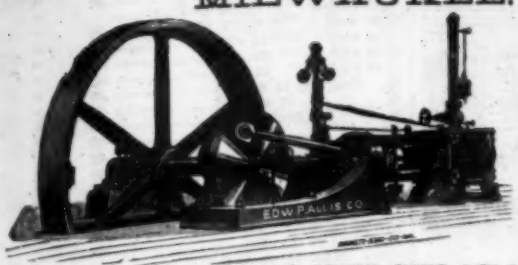
Beams and Channels (f. o. b. Cleveland)	1.60c
Angles	1.65c
Tees	1.65c
Universal Plates	2.25@2.35c
Sheared Plates	2.35c

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]
Rounds and Squares.—Bar Iron.

1 to 2	1.80 Base.
2 to 2½	.20 extra.
3 to 3½	.50 "
3½ to 4	.80 "
4½ to 4½	1.00 "
4½ to 5	1.30 "
5½ to 6	1.80 "
5 to 6½	2 "

THE EDWARD P. ALLIS COMPANY
MILWAUKEE, WIS.



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Blowing Engines, Hoisting Engines, Pumping Engines Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills Concentrators, General Mining Milling and Smelting Machinery.

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Weiss Counter-Current Condensers.

THE LANE & BODLEY CO.,
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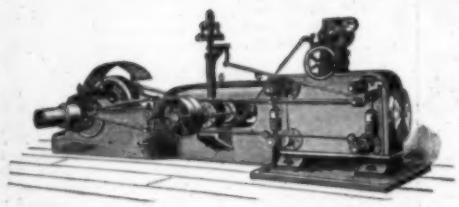


Engines,
ALL SIZES.

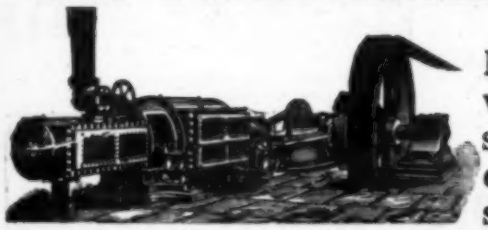
Simple and Compound.

Shafting, Hangers, Pullevs.

Belt Elevators, Saw Mills.

WILLIAM TOD & CO.
YOUNGSTOWN, OHIO.

The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Park Building, Pittsburg.
SEWARD S. BABBITT.

The Geo. B. Sennett Co., Youngstown, Ohio,

MANUFACTURERS OF

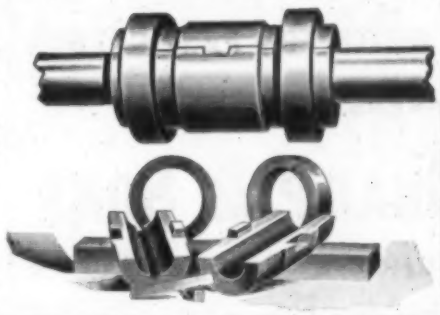
Sennett Compression Coupling

And Other Specialties.

We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.
We make also the

SENNETT ENGINE
20 to 40 H. P.

Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.



The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year $3.00.

6⅝ to 7½	2.00 extra
¾ to ⅞	1.10 "
⅝ to 11-16	.20 "
⅞ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13 2	.50 "
5-16 to 1 -32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.05 Base
4¼ o 6 x ⅜ to 1	.10 extra
6¼ o 8 x ⅜ to 1	.60 "
8¼ o 10 x ⅜ to 1	.80 "
1⅜ o 4 x 1 1-16 to 1½	.30 "
4¼ to 6 x 1 1-16 to 1½	.40 "
6¼ to 8 x 1 1-16 to 1½	.60 "
8¼ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ to 6 x 1⅝ to 2	.60 "
6¼ to 8 x 1⅝ to 2	.80 "
8¼ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ to 6 x 2⅛ to 3	.80 "
6¼ to 8 x 2⅛ to 3	1.00 "
1⅜ to 1⅝ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅞	.20 "
¼ to 15-16 x ⅜ to ⅞	.40 "
⅝ to 11-16 x ⅜ to ⅞	.50 "
⅛ to 9-16 x ⅜ to ⅞	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¼ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
⅛ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of **Heavy Bands.**

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¾ to 4 x No. 9 to 3-16	.40 "
1¾ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.
Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1⅜	.40 extra
¾ to 13-16	.50 "
⅝ to 11-16	.60 "
½ to 9-16	.80 "
¾ to 7-16	1.10 "
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11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
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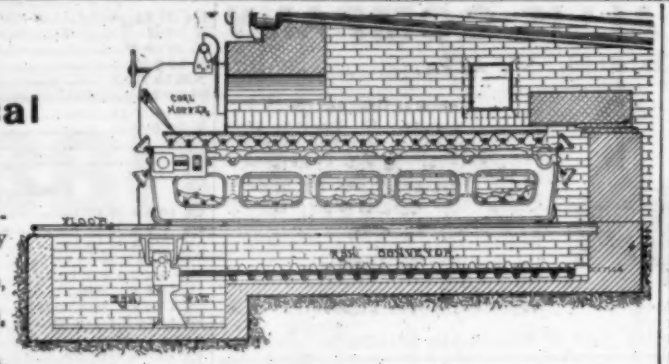

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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

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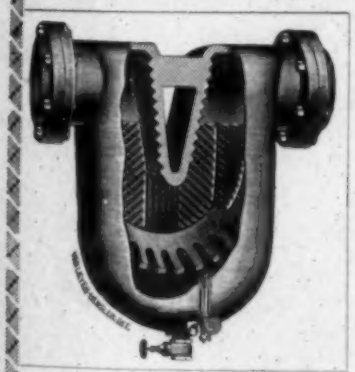

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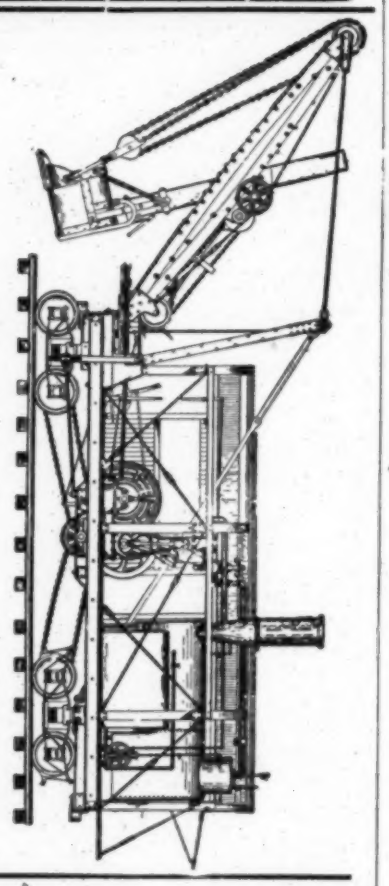

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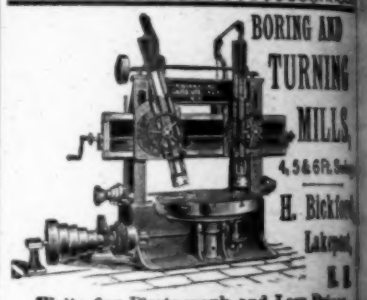

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